NAVSHIPS 91759

INSTRUCTION BOOK

for

SIGNAL GENERATOR SG-42/URM-18

GENERAL RADIO COMPANY
CAMBRIDGE, MASS.

BUREAU OF SHIPS NAVY DEPARTMENT

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PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
Title page	Original	4–1 to 4–2	Original
A to C	Original	5–1 to 5–2	Original
i to v	Original	6–1 to 6–3	Original
1–0 to 1–4	Original	7–0 to 7–14	Original
2–1 to 2–5	Original	8–1 to 8–12	Original
3–0	Original		

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS
WASHINGTON 25, D. C.

IN REPLY REFER TO
Code 993-100
18 November 1952

From: Chief, Bureau of Ships
To: All Activities Concerned with the Installation, Operation and Maintenance of the Subject Equipment

Subj: Instruction Book for Signal Generator SG-42/URM-18

1. This is the instruction book for the subject equipment and is in effect upon receipt.

2. When superseded by a later edition, this publication shall be destroyed.

3. Extracts from this publication may be made to facilitate the preparation of other Department of Defense Publications.

4. All Navy requests for NAVSHIPS Electronics publications should be directed to the nearest District Publications and Printing Office. When changes or revised books are distributed, notice will be included in the Bureau of Ships Journal and in the Index of Bureau of Ships General and Electronics Publications NAVSHIPS 250-020.

H. N. WALLIN
Chief of Bureau

RECORD OF CORRECTIONS MADE

CHANGE NO.	DATE	SIGNATURE OF OFFICER MAKING CORRECTION

TABLE OF CONTENTS

Paragraph *Page*

SECTION 1—GENERAL DESCRIPTION

1. Purpose and Basic Principles of Equipment 1–1
2. Description of Signal Generator SG–42/URM–18 1–1
3. Reference Data 1–3

SECTION 2—THEORY OF OPERATION

1. Functional Block Diagram 2–1
2. Theory of "DIRECT" and "REVERSE" Scales 2–1
3. Circuit Analysis 2–2

SECTION 3—INSTALLATION

1. Unpacking 3–0
2. Method of Mounting 3–0
3. Initial Adjustments 4–1

SECTION 4—OPERATION

1. Introduction 4–1
2. Standardization of Unit 4–1
3. Beat Indication Matching 4–1
4. Matching Weak Signals 4–2
5. Matching By Means of Cathode-ray Oscilloscope 4–2
6. Measurement of Small Changes in Frequency 4–2
7. Use of Unit As A Source of Audio Frequency 5–1
8. Realignment of Δf Dials 5–1

SECTION 5—OPERATOR'S MAINTENANCE

1. Daily Operational Check 5–1
2. Emergency Maintenance 5–1

SECTION 6—PREVENTIVE MAINTENANCE

1. Scope 6–1
2. Routine Check Chart 6–1
3. Maintenance Methods 6–1
4. Painting and Retouching 6–1
5. Lubrication 6–1

SECTION 7—CORRECTIVE MAINTENANCE

1. Failure Reports 7–1
2. Theory of Localizing Trouble 7–1
3. Trouble Shooting Chart 7–1
4. General Trouble Shooting Precautions 7–1
5. Trouble Shooting Data 7–2
6. Equipment Required for Alignment and Testing 7–2
7. Alignment Procedures and Final Testing 7–2

SECTION 8—PARTS LIST

LIST OF ILLUSTRATIONS

SECTION 1—GENERAL DESCRIPTION

Figure	Title	Page
1–1	Signal Generator SG–42/URM–18	1–0
1–2	Signal Generator SG–42/URM–18, Front Panel	1–1
1–3	Signal Generator SG–42/URM–18, Rear View	1–2

SECTION 2—THEORY OF OPERATION

2–1	Signal Generator SG–42/URM–18, Functional Block Diagram	2–1
2–2	Frequency Measuring Diagram for DIRECT and REVERSE Scales	2–2
2–3	Fixed Frequency Oscillator—42 or 47 kc (V1), Functional Diagram	2–3
2–4	Buffer Amplifier (V2), Functional Diagram	2–3
2–5	Variable Frequency Oscillator—42 to 47 kc (V4), Functional Diagram	2–3
2–6	Buffer Amplifier (V3) Functional Diagram	2–4
2–7	Detector (V5A), Functional Diagram	2–4
2–8	R-F Filter Circuit, Functional Diagram	2–4
2–9	Mixer (V6A), Functional Diagram	2–4
2–10	Input Amplifier (V7), Functional Diagram	2–5
2–11	Output Amplifier (V5B—V6B), Functional Diagram	2–5
2–12	Power Supply Section (V8, V9), Functional Diagram	2–5

SECTION 3—INSTALLATION

Figure	Title	Page
3–1	Signal Generator SG–42/URM–18, Unpacking Procedure	3–0

SECTION 4—OPERATION

4–1	Signal Generator SG–42/URM–18, Operating Panel Controls	4–2

SECTION 5—OPERATOR'S MAINTENANCE

5–1	Signal Generator SG–42/URM–18, Electron Tube Locations	5–2

SECTION 7—CORRECTIVE MAINTENANCE

7–1	Failure Report, Sample Form	7–0
7–2	Signal Generator SG–42/URM–18, Tube Socket Voltages and Resistances	7–4
7–3	Signal Generator SG–42/URM–18, Top View of Chassis	7–8
7–4	Signal Generator SG–42/URM–18, Bottom View of Chassis	7–9
7–5	Signal Generator SG–42/URM–18, Rear View of Chassis	7–10
7–6	Signal Generator SG–42/URM–18, Left-Side View of Chassis	7–11
7–7	Signal Generator SG–42/URM–18, Main Tuning Capacitor Assembly, Rear View	7–12
7–8	Signal Generator SG–42/URM–18, Main Tuning Capacitor Assembly, Front Side View	7–12
7–9	Signal Generator SG–42/URM–18, Schematic Diagram	7–13, 7–14

LIST OF TABLES

SECTION 1—GENERAL DESCRIPTION

Table	Title	Page
1–1	Equipment Supplied	1–3
1–2	Equipment and Publications Required But Not Supplied	1–3
1–3	Shipping Data	1–4
1–4	Electron Tube Complement	1–4

SECTION 5—OPERATOR'S MAINTENANCE

5–1	Operator's Emergency Check Chart	5–2

SECTION 6—PREVENTIVE MAINTENANCE

6–1	Routine Maintenance Check Chart	6–2

SECTION 7—CORRECTIVE MAINTENANCE

Table	Title	Page
7–1	Trouble Shooting Chart	7–3
7–2	Tube Operating Voltages and Currents	7–5
7–3	Tube Rated Characteristic Data	7–5
7–4	R-F and A–F Voltages at Coils and Tubes	7–6
7–5	Transformer and Coil Resistances	7–6
7–6	Winding Data	7–7

SECTION 8—PARTS LIST

8–1	Shipping Weights and Dimensions of Spare Parts Boxes	8–2
8–2	List of Major Units	8–2
8–3	Table of Replaceable Parts	8–3
8–4	Applicable Color Codes and Miscellaneous Data	8–12

GUARANTEE

Notwithstanding the provisions of Section 5 of these General Provisions, entitled "Inspection," the Contractor guarantees that at the time of delivery thereof the supplies provided for under this contract will be free from any defects in material or workmanship and will conform to the requirements of this contract. Notice of any such defect or non-conformance shall be given by the Government to the Contractor within one year of the delivery of the defective or non-conforming item, unless a different period of Guaranty is specified in the Schedule. If required by the Government within a reasonable time after such notice, the Contractor shall with all possible speed correct or replace the defective or non-conforming item or part thereof. When such correction or replacement requires transporation of the item or part thereof, shipping costs, not exceeding usual charges, from the delivery point to the Contractor's plant and return, shall be borne by the Contractor; the Government shall bear all other shipping costs. This Guaranty shall then continue as to corrected or replacing supplies or, if only parts of such supplies are corrected or replaced, to such corrected or replacing parts, until one year after the date of re-delivery, unless a different period of Guaranty is specified in the Schedule. If the Government does not require correction or replacement of a defective or non-concorming item, the Contractor, if required by the Contracting Officer within a reasonable time after the notice of defect or non-conformance, shall repay such portion of the contract price of the item as is equitable in the circumstances.

INSTALLATION RECORD

Contract Number NObsr 57083 Date of Contract, 16 Nov. 1951

Serial Number of Equipment .....

Date of Acceptance by the Navy .....

Date of delivery to Contract destination .....

Date of completion of installation .....

Date placed in service .....

Blank spaces on this page shall be filled in at time of installation. Operating personnel shall also mark the "date placed in service" on the date of acceptance plate below the model name plate on the equipment, using suitable methods and care to avoid damaging the equipment.

REPORT OF FAILURE

Report of failure of any part of this equipment, during its entire service life, shall be made to the Bureau of Ships in accordance with current regulations using form NAVSHIPS NBS 383 (revised). The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failures see Chapter 67 of the *Bureau of Ships Manual* or superseding instructions.

ORDERING PARTS

All requests or requisitions for replacement material should include the following data:

1. Federal stock number or, when ordering from a Marine Corps or Signal Corps supply depot, the Signal Corps stock number.
2. Name and short description of part.

If the appropriate stock number is not available the following shall be specified:

1. Equipment model or type designation, circuit symbol, and item number.
2. Name of part and complete description.
3. Manufacturer's designation.
4. Contractor's drawing and part number.
5. JAN or Navy type number.

DESTRUCTION OF ABANDONED MATERIAL IN THE COMBAT ZONE

In case it should become necessary to prevent the capture of this equipment and when ordered to do so, DESTROY IT SO THAT NO PART OF IT CAN BE SALVAGED, RECOGNIZED, OR USED BY THE ENEMY. BURN ALL PAPERS AND BOOKS.

Means:

1. Explosives, when provided.
2. Hammers, axes, sledges, machetes, or whatever object is readily available.
3. Burning by means of incendiaries such as gasoline, oil, paper or wood.
4. Grenades and shots from available firearms.
5. Burying all debris, where possible and when time permits.
6. Throwing overboard or disposing of in streams or other bodies of water.

Procedure:

1. Obliterate all identifying marks. Destroy nameplates and circuit labels.
2. Demolish all panels, castings, switch and instrument boards.
3. Destroy all controls, switches, relays, connections and meters.
4. Rip out all wiring and cut interconnections of electrical equipment. Smash gas, oil, and water cooling systems in gas engine generators, etc.
5. Smash every electrical or mechanical part, whether rotating, moving or fixed.
6. Break up all operating instruments such as keys, phones, microphones, etc.
7. Destroy all classes of carrying cases, straps, containers, etc.
8. Bury or scatter all debris.

DESTROY EVERYTHING

SAFETY NOTICE

The attention of officers and operating personnel is directed to Chapter 67 of the *Bureau of Ships Manual* or superseding instructions on the subject of radio safety precautions to be observed.

This equipment employs voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working with the equipment.

While every practical safety precaution has been incorporated in this equipment, the following rules must be observed:

KEEP AWAY FROM LIVE CIRCUITS:

Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors. To avoid casualties always remove power and discharge and ground circuits prior to touching them.

DON'T SERVICE OR ADJUST ALONE:

Under no circumstances should any person reach within the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS:

Do not depend upon door switches or interlocks for protection but always shut down motor generators or other power equipment. Under no circumstances should any access gate, door, or safety interlock switch be removed, short-circuited, or tampered with in any way, by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

RESUSCITATION

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR, OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

Figure 1–1. Signal Generator SG–42/URM–18

SECTION 1
GENERAL DESCRIPTION

1. PURPOSE AND BASIC PRINCIPLES OF EQUIPMENT.

a. Signal Generator SG–42/URM–18 is designed particularly for use in conjunction with standard-frequency equipment to measure the audio-frequency difference between the unknown frequency and a harmonic of 10 kc from the standard. This difference ranges from 0 to 5000 cycles for all such measurements.

b. Signal Generator SG–42/URM–18 is of the beat frequency type, with a direct-reading linear scale; each division of the scale corresponds to an increment of one cycle. A special feature is the use of "direct" and "reverse" scales permitting frequency measurements to be made by addition only. This feature is described in Section 2 (THEORY OF OPERATION).

c. Provision is made for readily introducing a standard frequency for checking the calibration of the Signal Generator SG–42/URM–18, utilizing the output voltmeter as a beat indicating meter. In a similar manner, an audio frequency whose value is to be determined, can be introduced. Separate volume controls are provided for adjustment of the levels of output signals of the Signal Generator SG–42/URM–18 and input signals from either the frequency standard or the source under measurement.

d. Two separate incremental-frequency dials (Δf DIRECT and Δf REVERSE), covering a range of plus or minus 10 cycles are provided for the "direct" and "reverse" scales. These are also used as zero adjustments. The theory of these dials is given in Section 2; their use is explained in Section 4.

2. DESCRIPTION OF SIGNAL GENERATOR SG–42/URM–18.

a. Signal Generator SG–42/URM–18 is shown in figure 1–1. A view of the front panel is given in figure 1–2; and a rear view of the unit in figure 1–3. The unit contains a fixed frequency oscillator (42 or 47 kc), a variable frequency oscillator (42 to 47 kc), buffer amplifiers for each oscillator, a detector, r-f

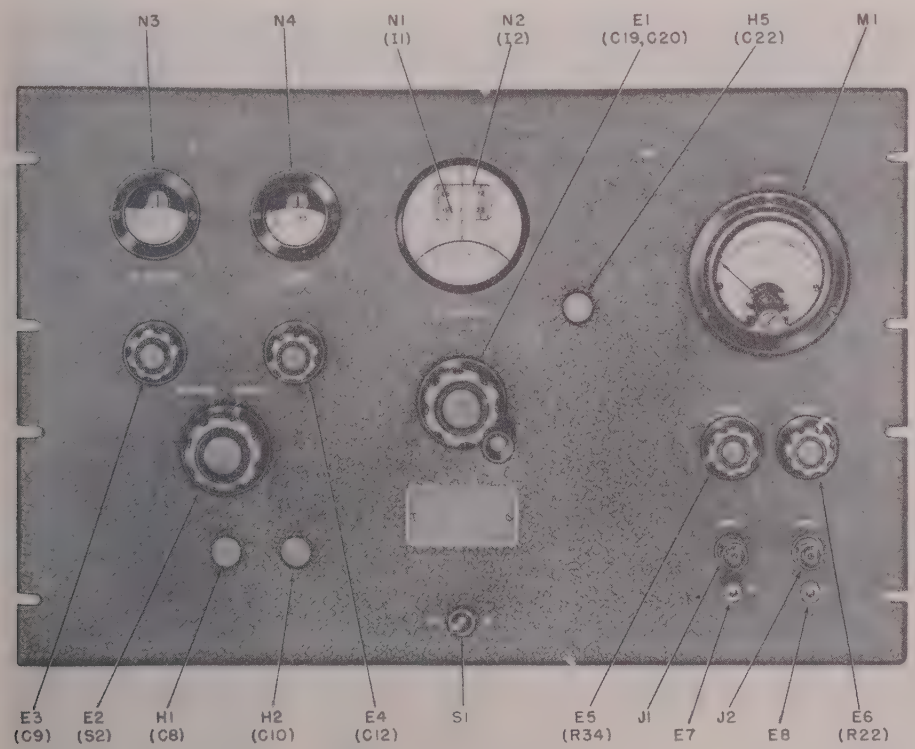


Figure 1–2. Signal Generator SG–42/URM–18, Front Panel

filter circuit, a mixer, an input amplifier, and an output amplifier. The unit is designed for mounting in a standard 19-in rack and its dimensions, volume, and weight are given in Table 1–1. The schematic diagram of the unit is given in figure 7–9.

b. The front panel (see figure 1–2) contains the following controls and indicating devices:

(1) In the center of the panel behind a transparent acetate window are the main FREQUENCY dials (N1 and N2) covering a range of 0–5000 cycles. (N1 is the DIRECT dial; N2 is the REVERSE dial.) Associated with these dials are indicating lights (I1 and I2). The control knob (E1) for setting the main FREQUENCY dials is directly below the dials. This knob controls variable capacitors C19 and C20. To the right of the main FREQUENCY dials is a cover cap (H5) underneath which is located the trimmer capacitor C22.

(2) On the left of the panel are two calibrated dials, Δf REVERSE (N3) and Δf DIRECT (N4) covering an incremental frequency range of plus or minus 10 cycles. These dials are also used as zero adjustments. The dials are protected by acetate windows mounted in bakelite bezels. The Δf and zero adjustment control knobs (E3 and E4) are directly below the Δf dials. The control knob E3 operates the variable capacitor C9; the knob E4 operates the variable capacitor C12. The REVERSE-DIRECT knob (E2) is used to operate the scale selector switch (S2). At the lower left are two cover caps (H1 and H2). Underneath H1 is the trimmer capacitor C8; under H2 is the trimmer capacitor C10.

(3) On the right of the panel is the OUTPUT voltmeter (M1); also used as a beat indicator. Below the meter are two control knobs, INPUT (E5) and OUTPUT (E6). The INPUT control operates a variable resistor (R34) to adjust the level of input audio frequency to be matched on the oscillator; the OUTPUT control operates a variable resistor (R22) to adjust the level of oscillator output. Directly below these controls are two concentric jacks, INPUT (J1) and OUTPUT (J2). The INPUT jack is used for introduction of the audio frequency to be matched on the oscillator; the OUTPUT jack is for oscillator output. Associated with the jacks are two binding posts (E7 and E8). These are used in conjunction with J1 and J2 to make connections by means of two-point plugs.

(4) At the bottom center of the panel is the ON-OFF power switch (S1) for connecting the unit to the power supply line.

c. On the rear of the unit (see figure 1–3) are located the power supply jack (J5), two fuses (F1 and F2) and two jacks marked "INPUT" (J3) and "OUTPUT" (J5). The jack J3 is connected in parallel with J1 on the front panel; the jack J4 is in parallel with J2 on the front panel.

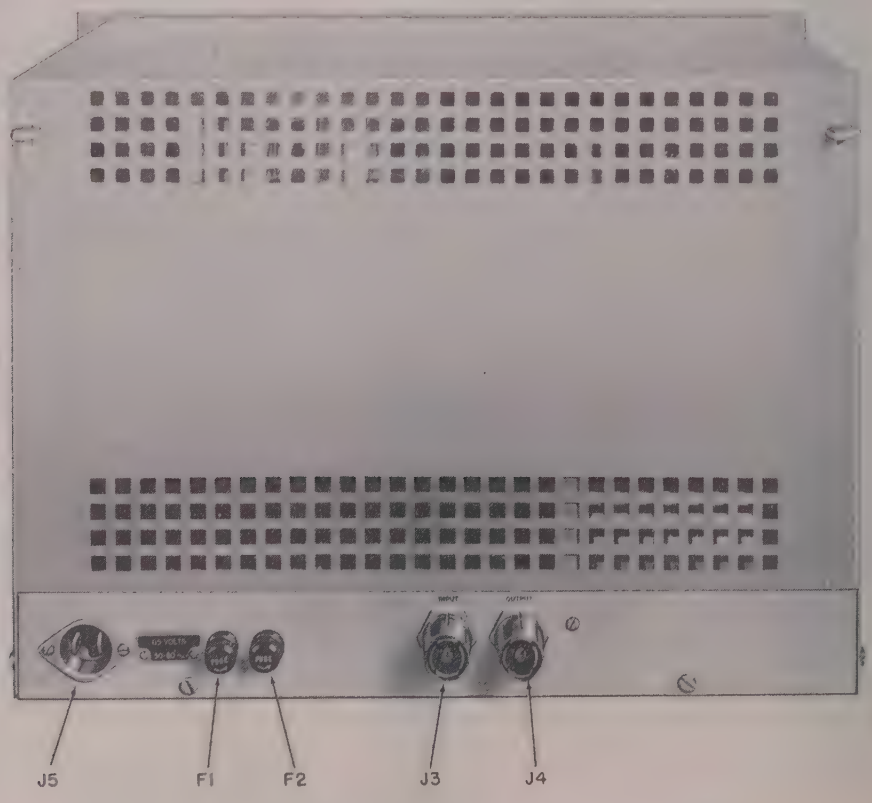


Figure 1–3. Signal Generator SG–42/URM–18, Rear View

3. REFERENCE DATA.

a. NOMENCLATURE: Signal Generator SG–42/URM–18.

b. CONTRACT NUMBER AND DATE: NObsr 57083; Nov. 16, 1951.

c. CONTRACTOR: General Radio Company, Cambridge, Mass.

d. COGNIZANT NAVAL INSPECTOR: INB-BOSTON.

e. NUMBER OF PACKAGES INVOLVED PER COMPLETE SHIPMENT OF EQUIPMENT: one shipping box containing two units.

f. TOTAL CUBICAL CONTENTS: Equipment crated 13.3 cubic feet (2 units); equipment uncrated 1.62 cubic feet (1 unit).

g. TOTAL WEIGHT: Equipment crated 170 pounds (2 units); equipment uncrated 40.5 pounds (1 unit).

h. FREQUENCY RANGE: 0–5000 cycles per second.

i. OUTPUT IMPEDANCE: The output circuit impedance is approximately 600 ohms. The output voltage is adjustable up to 15 volts.

j. DIAL CALIBRATION: The DIRECT dial is calibrated 0–5000 cycles with the oscillator frequency *increasing* from 0–5000 divisions on the scale. The REVERSE dial is calibrated 5000–10,000 cycles with the oscillator frequency *decreasing* from 5000 cycles to 0 while scale reading goes from 5000–10,000 divisions.

k. ACCURACY: The unit is aligned to agree with the linear direct-reading scales to within ±2 cycles. Small residual errors are easily and quickly removed in the region of any frequency in the range of fine adjustment of the zero with reference to a frequency standard having a 1-kc or 0.1-kc output, or both. For evaluating very small frequency differences independent direct-reading frequency increment dials (N3 and N4) are provided for the two scales (N1 and N2).

l. POWER SUPPLY: 105 to 125 volts AC (or 210 250 volts AC); 50 to 60 cycles. Power input is 50 watts approximately.

m. EQUIPMENT LISTS: Table 1–1 lists the equipment supplied; Table 1–2 lists the equipment and publications required but not supplied on the contract.

n. SHIPPING DATA: Table 1–3 gives information concerning the equipment and spare parts as packed for shipment.

o. ELECTRON TUBE COMPLEMENT: Table 1–4 lists the electron tubes used in the equipment.

TABLE 1–1. EQUIPMENT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	NAVY TYPE DESIGNATION	OVER-ALL DIMENSIONS			VOLUME	WEIGHT
			HEIGHT	WIDTH	DEPTH		
1	Signal Generator	SG–42/URM–18	12-1/4	19	12	1.62	40.5
1	Power Cord, Type CAP–35		*				

Dimensions are in inches; volume in cubic feet; weight in pounds.
* 7 feet long and 1-13/16 inches max. diam. of terminals.

TABLE 1–2. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	NAVY TYPE DESIGNATION	REQUIRED USE	REQUIRED CHARACTERISTICS
1	Piezo-Electric Oscillator (General Radio Type 1101–A, or equal)			Using an oscilloscope, the oscillator can be calibrated using 100 and/or 1000 cycles from a frequency standard. Using GR–1101–A and GR–1102–A these frequencies are obtainable with an accuracy of one part in ten million. Since the oscillator calibration
1	Instruction Book for above			
1	Multivibrator and Power Supply (General Radio Type 1102–A, or equal)		To furnish standard harmonic frequencies	
1	Instruction Book for above			

TABLE 1–2. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED—Continued

QUANTITY PER EQUIPMENT	NAME OF UNIT	NAVY TYPE DESIGNATION	REQUIRED USE	REQUIRED CHARACTERISTICS
1	Cathode-Ray Oscilloscope	Oscilloscope OS–8/U, Navy Model OBL or OBT Series	For checking calibration of Signal Generator SG–42/URM–18 against 100-cycle or 1000-cycle standard frequency	can be aligned only to about ±2 cycles, the *necessary* accuracy of a standard for checking the calibration could be much less, one part in 100,000 being more than sufficient.
1	Instruction Book for above			
1	Headset phones		To give audio indication of output	Should match output circuit impedance approx 600 ohms
1	Loudspeaker			
1 or more	Patch Cords		To connect source of unknown frequency to Signal Generator SG–42/URM–18	

TABLE 1–3. SHIPPING DATA

SHIPPING BOX NO.	CONTENTS		OVER-ALL DIMENSIONS			VOLUME	WEIGHT
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	Signal Generator (contains 2 units)	SG–42/URM–18	36	24	22	13.3	170

TABLE 1–4. ELECTRON TUBE COMPLEMENT

STAGE OF UNIT	NO. OF TUBES OF TYPE INDICATED				
	6SG7	6J5–GT	6SN7–GT	6X5–GT	OD3/VR150
Fixed frequency oscillator (V1)	1				
Buffer amplifier (V2)		1			
Buffer amplifier (V3)		1			
Variable frequency oscillator (V4)	1				
Detector (V5A) and Output amplifier (V5B)			1		
Mixer (V6A) and Output amplifier (V6B)			1		
Input amplifier (V7)		1			
Full wave amplifier (V8)				1	
Voltage regulator (V9)					1
Total number of Each Type	2	3	2	1	1

SECTION 2
THEORY OF OPERATION

1. FUNCTIONAL BLOCK DIAGRAM.

a. Signal Generator SG–42/URM–18 is designed for measuring the audio-frequency difference between an unknown frequency and a standard harmonic of 10 kc (obtained from a Piezo-Electric Oscillator and a Multivibrator and Power Supply; not supplied — see Table 1–2). The difference ranges from 0 to 5000 cycles for all such measurements. As shown in the block diagram figure 2–1, the unit consists of the following:

(1) Fixed frequency oscillator, 42 or 47 kc (V1).
(2) Buffer amplifier (V2).
(3) Variable frequency oscillator, 42 to 47 kc (V4).
(4) Buffer amplifier (V3).
(5) Detector (V5A).
(6) R-f filter circuit.
(7) Mixer (V6A).
(8) Input amplifier (V7).
(9) Audio amplifier (V5B–V6B).
(10) Power supply section (V8, V9).

The schematic diagram of the unit is shown in figure 7–9.

b. The operation of the unit is as follows: The 42 or 47 kc fixed frequency oscillator (V1) feeding through the buffer amplifier (V2), and the 42 to 47 kc variable frequency oscillator (V4) feeding through the buffer amplifier (V3) together feed into the detector (V5A). From the detector the beat frequency is then fed through the r-f filter circuit into the mixer (V6A). The unknown audio frequency is also fed to the mixer through the input amplifier (V7). The output of the mixer is then introduced into the audio amplifier (V5B—V6B) and beats are observed on the OUTPUT meter (M1), or by means of headphones or loudspeaker. Power for filaments and plates are supplied by the power supply section of the unit.

c. Separate incremental frequency dials (N3 and N4) covering a range of ± 10 cycles are provided on the panel of the unit for both DIRECT and REVERSE scales. These are also used as zero adjustments. The DIRECT and REVERSE scales (N1 and N2) make it possible to make frequency measurements by addition only. This feature of Signal Generator SG–42/URM–18 is described in the next paragraph.

2. THEORY OF "DIRECT" AND "REVERSE" SCALES.

a. The audio frequency output of 0–5000 cycles as stated above, is derived from the difference in frequency of two r-f oscillators; one operating at a fixed frequency of 42 or 47 kc, and the other operating at a variable frequency of 42 to 47 kc. The fixed frequency of 42 or 47 kc is selected by the DIRECT and REVERSE positions of the switch S2. In the DIRECT position, as the FREQUENCY dial is moved on the 0–500 division scale the output frequency varies from zero *upward* to 5000 cycles. In the REVERSE position as the dial is moved over the 0–5000 division scale, the output frequency varies from 5000 cycles *downward* to zero. The REVERSE scale is separate from the DIRECT scale and is marked 5000 to 10,000

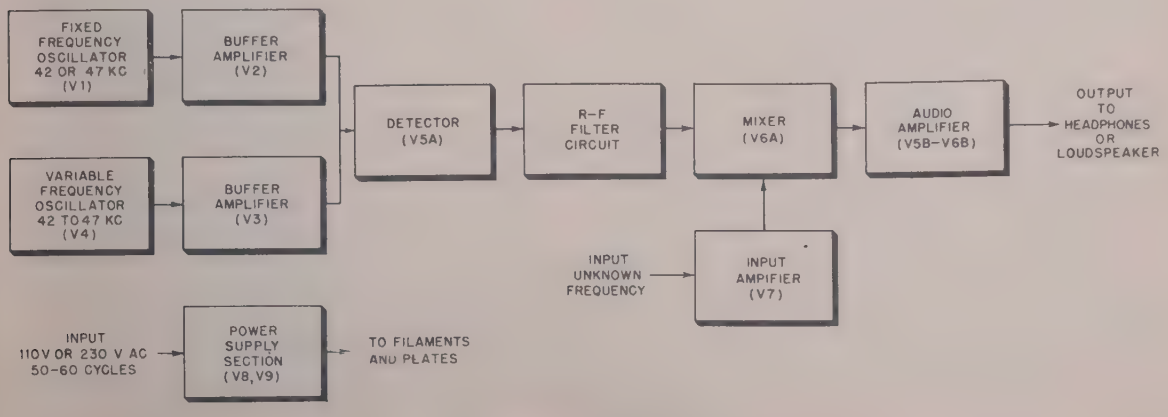

FIXED FREQUENCY OSCILLATOR 42 OR 47 KC (V1)
BUFFER AMPLIFIER (V2)
VARIABLE FREQUENCY OSCILLATOR 42 TO 47 KC (V4)
BUFFER AMPLIFIER (V3)
DETECTOR (V5A)
R-F FILTER CIRCUIT
MIXER (V6A)
AUDIO AMPLIFIER (V5B-V6B)
OUTPUT TO HEADPHONES OR LOUDSPEAKER
INPUT UNKNOWN FREQUENCY
INPUT AMPIFIER (V7)
INPUT 110V OR 230 V AC 50-60 CYCLES
POWER SUPPLY SECTION (V8,V9)
TO FILAMENTS AND PLATES

Figure 2–1. Signal Generator SG–42/URM–18, Functional Block Diagram

cycles. The scales are illuminated by two separate lights (I1 and I2) and the illumination changes from one scale to the other as the DIRECT-REVERSE switch (S2) is operated.

b. Figure 2-2 indicates the theory of using the DIRECT-REVERSE scales in measuring unknown frequencies in conjunction with a 10-kc harmonic standard frequency.

(1) In (A) of figure 2-2 the unknown frequency f_x is *less* than 5000 cycles above the 10-kc standard frequency harmonic f_1. Using the DIRECT scale, the difference in frequency $f_x - f_1 = f_b$ is matched by the Signal Generator. The value of f_x is then given as $f_x = f_1 + f_b$.

(2) In (B) of figure 2-2 the unknown frequency f_x is *more* than 5000 cycles above the 10-kc standard frequency harmonic f_1. Using the DIRECT scale, the difference in frequency $f_2 - f_x = f_b$ is matched by the Signal Generator. The value of f_x is then given as $f_x = f_2 - f_b$. It will be noted that the DIRECT scale corresponds to the usual type of signal generator having but one scale; and also that the scale divisions are laid off to the *left* of f_2, that is, *in a negative direction* corresponding to the subtraction of f_b from f_2.

(3) In (C) of figure 2-2 the use of the REVERSE scale is indicated. On throwing the switch S2 to the REVERSE position the fixed oscillator frequency (42 kc) is shifted by 5000 cycles (to 47 kc). The output frequency then varies from 5000 cycles at zero divisions on the original scale to zero to 5000 divisions; thus the sense of the frequency change with dial reading has been reversed. Using the original vernier dial, a new main scale is provided marked to read 5000 divisions at the zero point of the original scale; and 10,000 divisions at the 5000 division point of the original scale. For the same value of $f_2 - f_x = f_b$, as shown in (B) of figure 2-2 the actual output frequency of the Signal Generator must, of course, be the same as before to obtain a match. Referring to the initial 10-kc standard harmonic frequency f_1 there can now be written for $f_x = f_2 - f_b$ the equation $f_x = f_1 + (f_2 - f_1 - f_b)$. Substituting f_b' for $(f_2 - f_1 - f_b)$ there can be written $f_x = f_1 + f_b'$. The difference $(f_2 - f_1)$ is, of course, equal to 10 kc (the base standard frequency). The quantity in parenthesis $(f_2 - f_1 - f_b)$ is then equal to 10 kc minus the beat frequency f_b. This quantity is the same as f_b' read in a positive sense from f_1 (the initial 10-kc standard frequency harmonic) and $f_x = f_1 + f_b'$, where f_b' is read from the scale provided for the REVERSE position of switch S2.

(4) In (D) of figure 2-2 the frequency and dial divisions of the Signal Generator are shown, for use of the DIRECT and REVERSE scales, as required for covering a complete interval from 1-kc standard frequency harmonic f_1 to the next higher frequency f_2. In effect (D) of figure 2-2 combines (A) and (C) of the same figure.

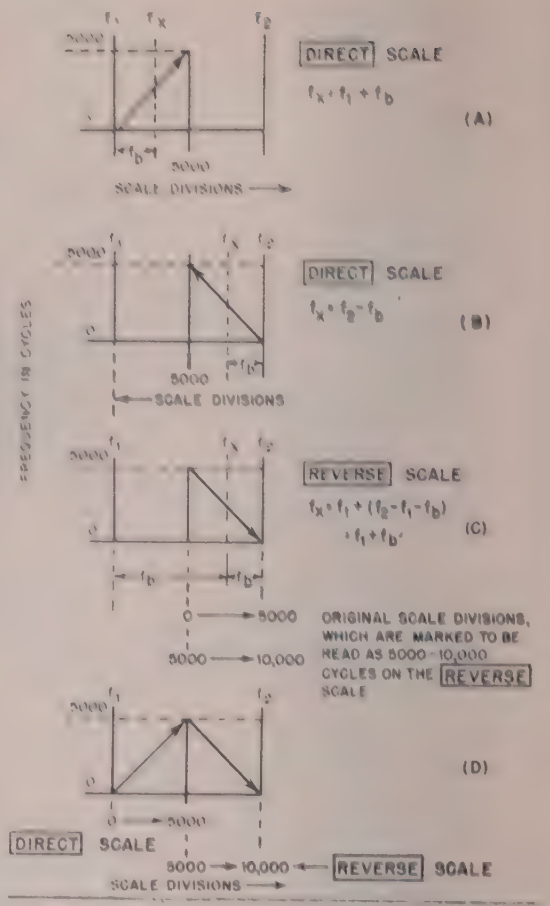


Figure 2-2. Frequency Measurement Diagram for DIRECT and REVERSE Scales

3. CIRCUIT ANALYSIS.

a. FIXED FREQUENCY OSCILLATOR, 42 or 47 kc (V1), see figure 2-3.

(1) The oscillator tuned circuit consists principally of L1, C2, C3, and C4. Adjustments for DIRECT and REVERSE scales are provided by C8, C9, C10, C11, C12, and S2. The capacitor C9 is the Δf (and zero set) capacitor for the REVERSE switch position (S2) and C12 is the Δf (and zero set) capacitor for the DIRECT switch position (S2).

(2) The input to the oscillator tube (V1) is taken across C2 of the tuned circuit by way of grid capacitor C1 and suppressor resistor R43. Grid bias is provided by grid leak R1.

(3) The output of the oscillator tube (V1) is passed to C3 of the oscillator tuned circuit by means of the cathode connection to C3. The plate of the oscillator tube (V1) is by-passed to ground for radio-frequencies by C5. The r-f choke L2 provides a path for the d-c cathode current of the tube.

(4) The screen voltage supply for the oscillator tube is obtained from the voltage divider R2, R3 by-passed by C6. The resistor R3 is provided to regulate the amplitude of oscillation.

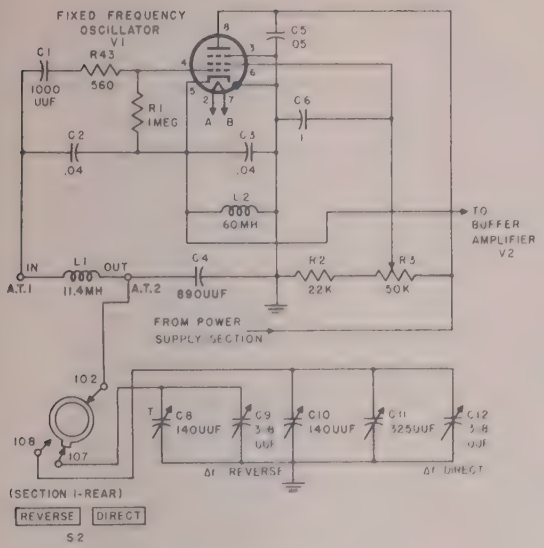


Figure 2–3. Fixed Frequency Oscillator 42 or 47 kc (V1), Functional Diagram

(5) Output from the oscillator is taken across C4 to the buffer amplifier (V2).

b. BUFFER AMPLIFIER (V2), see figure 2–4.

(1) The buffer amplifier is of the cathode-follower type with input from the fixed frequency oscillator by way of the grid capacitor C13. Output is taken from the cathode resistors R5 or R8. Bias is provided by R7, through grid leak resistor R4.

(2) Separate output adjustments are provided for the two positions of the DIRECT-REVERSE switch (S2), to account for differences in oscillator level in the two cases. The output voltage is taken to the detector (V5A) through the isolating resistor R6.

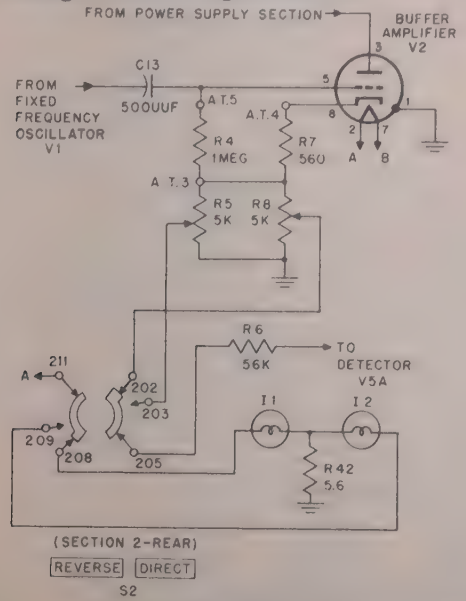


Figure 2–4. Buffer Amplifier (V2), Functional Diagram

(3) The indicator lights I1 and I2 are switched so that the proper index on the frequency dial is illuminated for the DIRECT and REVERSE switch positions.

c. VARIABLE FREQUENCY OSCILLATOR, 42 to 47 kc (V4), see figure 2–5.

(1) The oscillator tuned circuit consists principally of L3, C17, C18, C19, C20. Trimmer adjustments are provided by C21, C22. The main frequency control is C19.

(2) The input to the oscillator tube (V4) is taken across C17 of the oscillator circuit by way of grid capacitor C16 and suppressor resistor R44. Grid bias is provided by grid leak R13.

(3) The output of the oscillator tube (V4) is passed to C18 of the tuned circuit by means of the cathode connection to C18. The plate of the oscillator tube is by-passed to ground for radio frequencies by C23. The r-f choke L4 provides a path for the d-c cathode current of the tube.

(4) The screen voltage supply for the oscillator tube is obtained from the voltage divider R14, R15; by-passed by C24. The resistor R15 is provided to regulate the amplitude of oscillation.

(5) Output from the oscillator is taken across C18 to the buffer amplifier (V3).

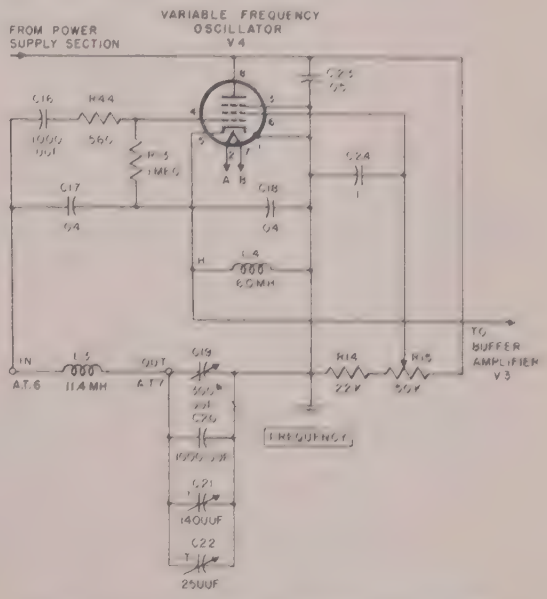


Figure 2–5. Variable Frequency Oscillator 42 to 47 kc (V4), Functional Diagram

d. BUFFER AMPLIFIER (V3), see figure 2–6.

(1) The buffer amplifier is of the cathode-follower type with input from the variable frequency oscillator by way of the grid capacitor C15. Output is taken from the cathode resistors R10, R11. Bias is provided by R10, through the grid leak resistor R12.

(2) Output is taken to the detector (V5A) through the isolating resistor R9.

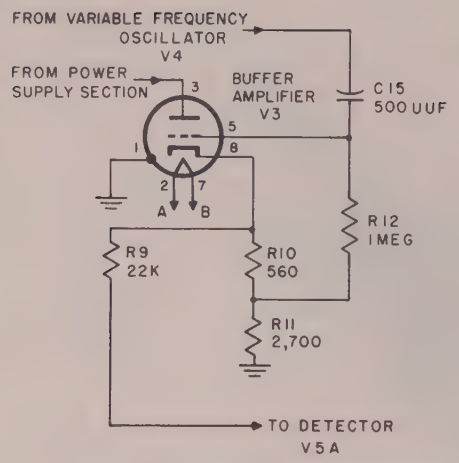


Figure 2–6. Buffer Amplifier (V3), Functional Diagram

e. DETECTOR (V5A), see figure 2–7.

(1) The inputs to the detector are brought from the buffer amplifiers (V2, V3) to the common terminating resistor R17, thence to the detector grid by way of the grid capacitor C25.

(2) No bias is supplied to the grid. Grid leak R18 is provided for detection.

(3) Output from the detector is taken across the plate load resistor R19 by way of the r-f filter circuit.

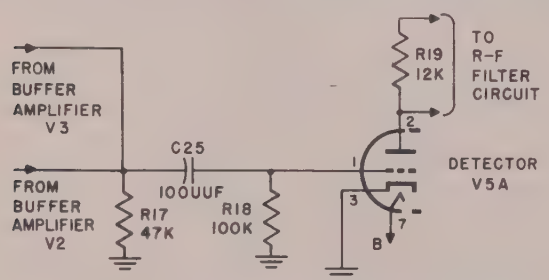


Figure 2–7. Detector (V5A), Functional Diagram

f. R-F FILTER, see figure 2–8.

(1) The r-f filter is a band-pass filter consisting of L5, C26, C27, C28 and is terminated in resistor R20.

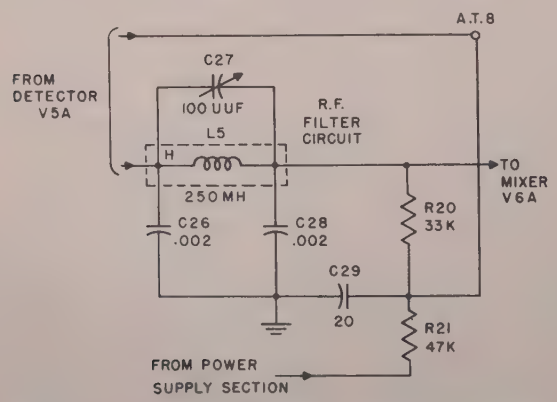


Figure 2–8. R-F Filter Circuit, Functional Diagram

(2) The d-c plate supply to the detector (V5A) is taken through the decoupling filter R21, C29.

(3) R-f output from the filter is taken across the terminating resistor R20 to the mixer (V6A).

g. MIXER (V6A), see figure 2–9.

(1) The a-f input to the mixer tube (V6A) is taken from the r-f filter by way of the grid capacitor C30 and grid resistors R22, R23. The resistor R22 is made variable to adjust the r-f input level to the mixer.

(2) The audio frequency to be matched is injected in the mixer cathode circuit across R24 by way of coupling capacitor C38, from the input audio frequency amplifier (V7).

(3) The d-c plate supply for the mixer is taken by way of the decoupling filter R26, C31 to the plate coupling resistor R25.

(4) The audio frequency output of the mixer is taken across the plate load resistor R25 to the audio amplifier (V5B–V6B).

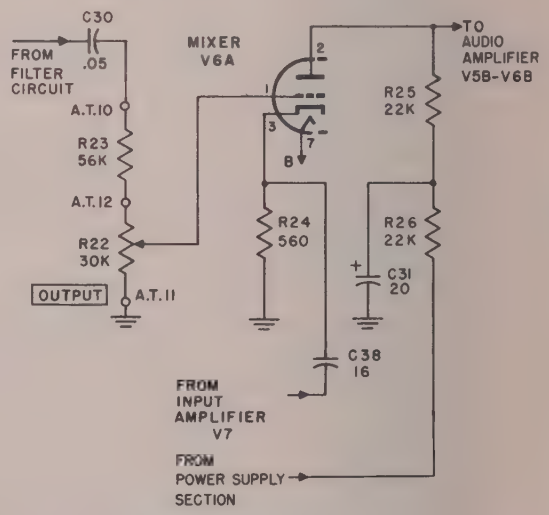


Figure 2–9. Mixer (V6A), Functional Diagram

h. INPUT AMPLIFIER (V7), see figure 2–10.

(1) The input amplifier is provided to inject the frequency to be matched into the mixer (V6A), independent of the impedance of the external source. The external signal can be connected to the amplifier either at the panel jack J1, or at the jack J3 at the rear.

(2) The input is passed to the amplifier by way of the coupling capacitor C36, volume control R34, and grid capacitor C37.

(3) The d-c plate voltage supply is by way of the decoupling filter R38, C39.

(4) The output is taken from the cathode resistors R36, R37 to the mixer. Bias is provided by R36 through the grid leak resistor R35.

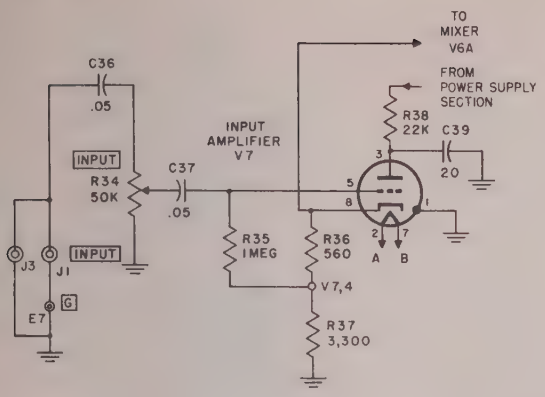


Figure 2–10. Input Amplifier (V7), Functional Diagram

i. AUDIO AMPLIFIER (V5B–V6B), see figure 2–11.

(1) The audio amplifier consists of one resistance-capacitance coupled stage (V5B) and a cathode follower output stage (V6B).

(2) The audio frequency voltage from the mixer (V6A) is taken to the first stage by way of grid capacitor C32. The cathode resistor R28 supplies bias by way of the grid resistor R27. The resistor R28 is not by-passed, so some degeneration is supplied to improve the linearity of the amplifier. The d-c plate supply of the first stage is by way of the decoupling filter R30, C33 to the plate coupling resistor R29.

(3) Output from the first stage is taken across the plate coupling resistor R29 to the input of the second stage (V6B) by way of the coupling capacitor C34.

(4) Output from the second stage is taken across the cathode resistors R32, R33, by way of the coupling capacitor C35, to the output meter (M1) and the output jacks J2 (on panel) and J4 (on rear). Bias is supplied by R32 by way of grid resistor R31.

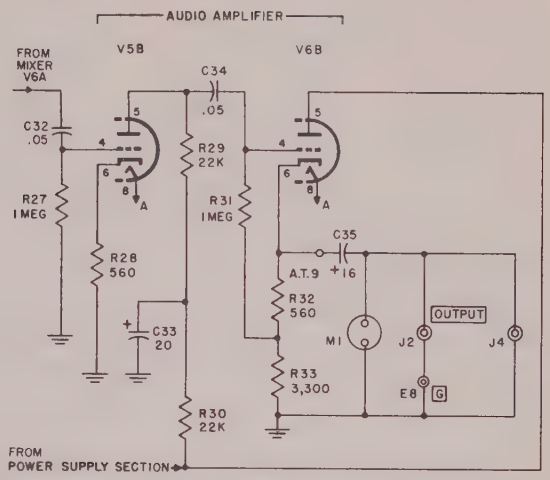


Figure 2–11. Audio Amplifier (V5B–V6B), Functional Diagram

j. POWER SUPPLY SECTION (V8, V9), see figure 2–12.

(1) Power is supplied from the line jack J5 through the r-f filter C40, C41, fuses F1, F2, and switch S1, to the primary of the transformer T1. For 115-volts operation the primary windings are in parallel; for 230-volt operation the windings are connected in series.

(2) Three secondary windings are provided, for rectifier plate and filament and for tube heaters for all tubes of the instrument.

(3) The rectified current from the rectifier (V8) is filtered in the power supply filter R39, C42, R40, C43, R41 and C44. A regulated supply is provided by use of a regulator tube (V9) and resistor R16; this supply is for the oscillator tubes (V1, V4).

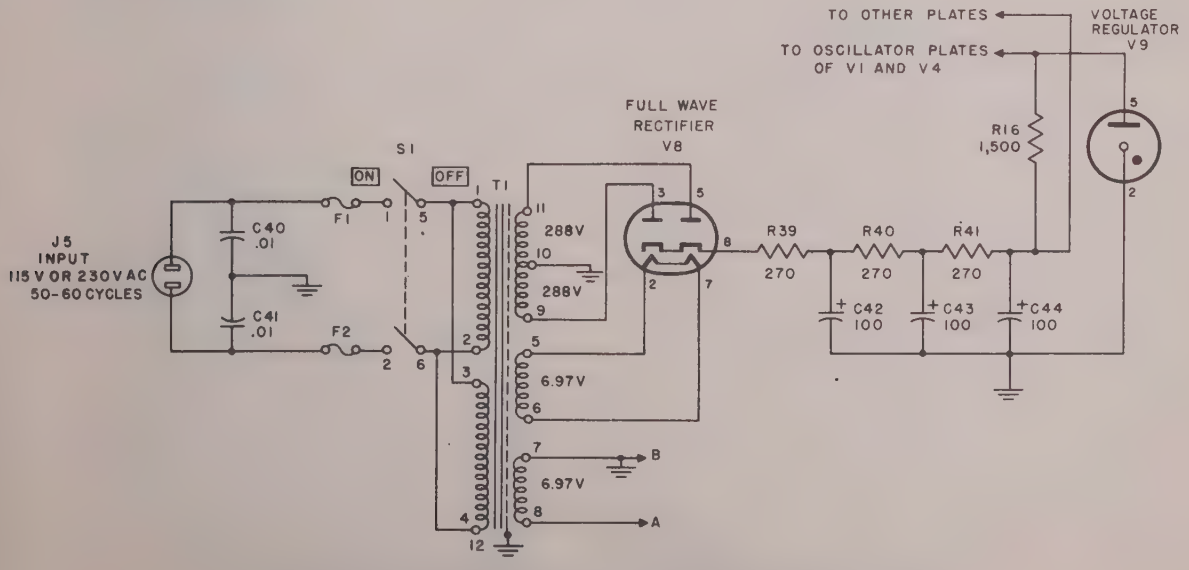


Figure 2–12. Power Supply Section (V8, V9), Functional Diagram

SECTION 3
INSTALLATION

1. UNPACKING.

a. Signal Generator SG–42/URM–18 is packed for shipment as shown in figure 3–1. The instructions given in that illustration should be followed when unpacking the equipment. Shipping data is given in Table 1–3.

b. Exercise extreme care when unpacking and handling the equipment. It can be easily damaged and thus required complete overhaul or rendered completely useless.

c. Remove nails from the packing case with a nail puller. Lift off the top; do not pry it off as this procedure may cause damage to the equipment.

2. METHOD OF MOUNTING.

a. Signal Generator SG–42/URM–18 is designed for mounting in a standard 19-in rack. The unit is held in place in the rack by eight screws passing through slots on the sides of the front panel. (See figure 1–2.)

b. After the unit has been installed in the standard 19-in rack, connections should be made on the rear of the unit as follows: (See figure 1–3.)

(1) Connect the power supply jack (J5) to a 115 volt AC, 50–60 cycle power supply line.

(2) Check fuses (F1 and F2) to be sure they are rated 0.6 amp.

CAUTION

Signal Generator SG–42/URM–18 when shipped is wired and fused for operation from 105–125 volt AC, 50–60 cycle, power supply lines. If 210–250 volt AC, 50–60 cycle power lines are used, the transformer (T1) must have its connections changed so that terminal No. 2 is connected to No. 3 (see figure 7–9). Also fuses (F1 and F2) must be changed to ones rated 0.3 amp.

(3) If it is desired to introduce the source of unknown frequency at the rear of the unit make con-

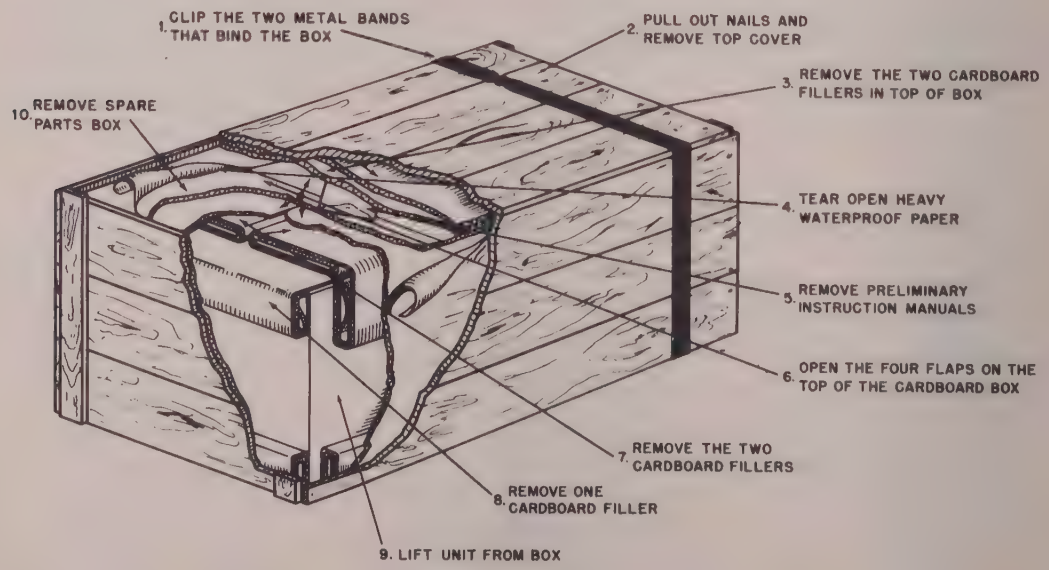

1. CLIP THE TWO METAL BANDS THAT BIND THE BOX
2. PULL OUT NAILS AND REMOVE TOP COVER
3. REMOVE THE TWO CARDBOARD FILLERS IN TOP OF BOX
4. TEAR OPEN HEAVY WATERPROOF PAPER
5. REMOVE PRELIMINARY INSTRUCTION MANUALS
6. OPEN THE FOUR FLAPS ON THE TOP OF THE CARDBOARD BOX
7. REMOVE THE TWO CARDBOARD FILLERS
8. REMOVE ONE CARDBOARD FILLER
9. LIFT UNIT FROM BOX
10. REMOVE SPARE PARTS BOX

Figure 3–1. Signal Generator SG–42/URM–18, Unpacking Procedure

nection for same to the INPUT jack (J3). This jack is connected in parallel with the INPUT jack (J1) on the front panel.

(4) If it is desired to connect the output of the unit from the rear make connection for same to the OUTPUT jack (J4). This jack is connected in parallel with the OUTPUT jack (J2) on the front panel.

(5) Electron tubes are normally shipped in place; if not install tubes in accordance with tube tags. The electron tube complement is given in Table 1–4.

3. INITIAL ADJUSTMENTS.

a. Signal Generator SG–42/URM–18 is a self-contained unit and requires no initial adjustment prior to operation.

b. This unit is adjusted at the factory so that the main FREQUENCY dial scales are direct-reading within ± 2 cycles. When the power switch (S1) is thrown to ON a bright disk of light should appear at the index of the scale; this disk will appear on the lower scale when the DIRECT-REVERSE switch (S2) is in the DIRECT position; the disk will appear on the upper scale when the switch is in the REVERSE position. The disk of light thus serves as a "pilot light" as well as indicating the scale in use.

SECTION 4
OPERATION

1. INTRODUCTION.

a. Since Signal Generator SG–42/URM–18 is designed for measuring the audio-frequency difference between an unknown frequency and a standard harmonic of 10 kc the operator must have a thorough understanding of the theory of operation of the unit before attempting to make any measurements. This theory is given in Section 2.

b. As equipment furnishing sources of a standard frequency and a cathode-ray oscilloscope are also required when making measurements with the Signal Generator the operator should likewise be familiar with the theory and operation of such equipment (see Table 1–2 for types of equipment and instruction books covering them).

2. STANDARDIZATION OF UNIT.

a. Since the unit is normally used as a signal generator in conjunction with a frequency standard the unit should first be standarized. A rapid and convenient checking of the Signal Generator SG–42/URM–18 calibration against a 100-cycle, or 1000-cycle standard frequency can be done using such a source and a cathode-ray oscilloscope. This method provides a tremendous number of known frequencies so that the Signal Generator can be checked at points within 10 cycles of any frequency in the range from 0 to 5000 cycles. In use it is more convenient to bring the scale error to zero, by adjustment of the Δf dial as a "zero set," than it is to determine the value of the error. Before making any measurements the Signal Generator should accordingly be standardized using this method.

b. When the Signal Generator is not being used with a frequency standard a few volts derived from the a-c power line can be used as a standarizing source for a few limited number of calibration points.

3. BEAT INDICATION MATCHING.

a. In matching an unknown frequency with the Signal Generator it is generally most convenient to also listen to the beat on headphones or loudspeaker while matching the beats on the OUTPUT meter (M1). To do so, headphones or a loudspeaker should be connected to the OUTPUT jack (J2) on the panel; or to OUTPUT jack (J4) on the rear of the unit. It may be necessary to use adaptor cables to make the connection or they may be made through a control or coupling panel in the standard 19-in rack.

b. When connections as above have been made throw the power switch (S1) to ON (see figure 4–1). Turn the OUTPUT volume control (R22) full counterclockwise. If the source being measured provides ample signal adjust the INPUT volume control (R34) until a deflection of roughly one-half scale is obtained on the OUTPUT meter (M1). Next adjust the FREQUENCY dial (N1 and N2) nearly to the frequency being measured. If the unknown frequency is *less* than 5000 cycles above the 10-kc standard frequency harmonic throw the REVERSE-DIRECT switch (S2) to the DIRECT position and read on the lower scale (N1) of the FREQUENCY dial. If the unknown frequency is *more* than 5000 cycles above the 10-kc standard frequency harmonic throw the REVERSE-DIRECT switch (S2) to the REVERSE position and read on the upper scale (N2) of the FREQUENCY dial. The scales of the main FREQUENCY dial are illuminated by two separate lights (I1 and I2) and the illumination changes from one scale to the other as the DIRECT-REVERSE switch (S2) is operated (see Section 3, paragraph 3). Under these conditions the needle of the OUTPUT meter (M1) will swing from nearly zero to nearly full scale. Accurate matching is then obtained when the frequency of the Signal Generator is adjusted to stop the motion of the needle

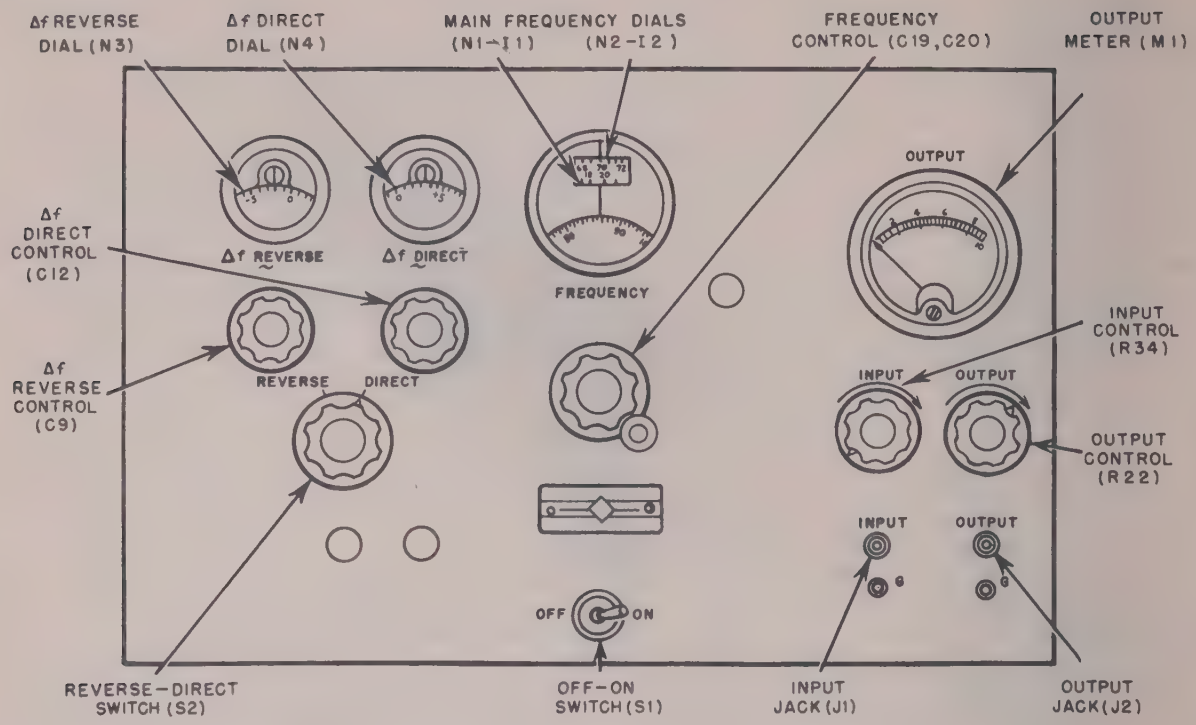


Figure 4–1. Signal Generator SG–42/URM–18, Operating Panel Controls

of the OUTPUT meter at any point of the swing.

c. Upon completion of measurement turn off the equipment by throwing the power switch (S1) to the OFF position.

4. MATCHING WEAK SIGNALS.

a. If the source being measured provides only a weak signal advance the INPUT control (R34) to maximum (clockwise). Then advance the OUTPUT control (R22) only far enough to cause the meter needle to swing near to zero on the scale. This adjustment gives the greatest possible swing but it may be, however, over only the first few divisions of the meter scale.

b. If the Signal Generator has been set to one-half or twice the frequency measured, although a small swing of the meter needle may be observed, it is not possible to obtain the pronounced swings down to zero as described in paragraph 3.

5. MATCHING BY MEANS OF CATHODE-RAY OSCILLOSCOPE.

a. In matching a very low frequency, it is difficult to tell by ear whether or not the frequency of the Signal Generator is equal to the frequency being measured. It is often found that the Signal Generator has been set to one-half or to twice the low frequency. With the precautions previously outlined it is usually possible to get a match by using the OUTPUT meter, but more reliable indications (and generally the procedure is much quicker), can be obtained by using a cathode-ray oscilloscope. Furthermore, by using a cathode-ray oscilloscope for matching the form of the pattern viewed leaves no doubt as to the frequency ratio. A further advantage lies in the fact that the Signal Generator can be set to a known multiple of the frequency being measured and accordingly a more accurate result will be obtained.

b. For information concerning the type of cathode-ray oscilloscope to be used and instruction book covering its operation refer to Table 1–2.

6. MEASUREMENT OF SMALL CHANGES IN FREQUENCY.

a. The Δf DIRECT increment dial scale (N4) and the Δf REVERSE increment dial scale (N3) are provided for measuring small changes in frequency. The scales cover minus 10 cycles to plus 10 cycles and are marked in 0.5 cycle divisions. The Δf DIRECT dial is used when the REVERSE-DIRECT switch (S2) is in the DIRECT position; the Δf REVERSE dial is used when the switch is in the REVERSE position.

b. To measure small changes in frequency set the Δf dial in use at zero. The Δf REVERSE dial is set by the Δf REVERSE control (C9); the Δf DIRECT dial is set by the Δf DIRECT control (C12). Next adjust the main FREQUENCY control (N1 and N2) to the reference frequency. The small changes in frequency are then matched by use of the Δf dial; the

plus portion of the dial indicates an increase in frequency from the reference value; the minus portion indicates a decrease in frequency from the reference value.

7. USE OF UNIT AS A SOURCE OF AUDIO FREQUENCY.

a. The Signal Generator SG–42/URM–18 may be used as a source of an audio frequency. To do so use the DIRECT scale, and turn the INPUT control (R34) to minimum (counterclockwise).

b. The output voltage is controlled by adjustment of the OUTPUT control (R22). The OUTPUT meter (M1) indicates the voltage applied to the load connected to the OUTPUT jacks (J2 and J4).

8. REALIGNMENT OF Δf DIALS.

a. Over a period of time the setting of the Δ f REVERSE and Δ f DIRECT dials may drift from zero when the main FREQUENCY dial is set to correct reading against a standard frequency. When this occurs realignment of the dials is made as follows:

Step 1. Set the main FREQUENCY dial (N1 and N2) to the correct reading for frequency of the standard.

Step 2. Adjust the Δ f dial for zero beat.

Step 3. Adjust the trimmer capacitor corresponding with the Δ f dial in use until zero beat is again obtained at zero on the Δ f dial. The trimmer capacitor (C8) for the Δ f REVERSE dial is under cover cap H1; the trimmer capacitor (C10) for the Δ f DIRECT is under cover cap H2 (see figure 1–2).

Step 4. If it is found that the number of divisions on the main FREQUENCY dial to cover the range from 1 to 5000 cycles is *greater* than the correct number it indicates that the variable capacitance is too *small* relative to the fixed capacitance in the variable oscillator circuit. The initial capacitance of the circuit should therefore be *reduced* slightly as directed in Step 6.

Step 5. If it is found that the number of divisions on the main FREQUENCY dial to cover the range from 1 to 5000 cycles is *less* than the correct number, it indicates that the variable capacitance is too *large* relative to the fixed capacitance in the variable oscillator circuit. The initial capacitance of the circuit should therefore be *increased* slightly as directed in Step 6.

Step 6. To *reduce* or *increase* initial capacitance as covered by Step 4 and Step 5 adjust the trimmer capacitor C22 under cover cap H5 (See figure 1–2).

Step 7. Having made a change in the setting of the trimmer capacitor C22 reset the Signal Generator to 1 kc and readjust the Δ f trimmer capacitors (C8 and C10) as necessary; then check the scale reading obtained at 5 kc.

Step 8. Repeat the trimmer adjustment as necessary to obtain correct alignment.

SECTION 5

OPERATOR'S MAINTENANCE

1. DAILY OPERATIONAL CHECK.

a. To insure satisfactory operation of Signal Generator SG–42/URM/18 the unit should be given a daily operational check. Turn on the unit and operate it in accordance with instructions given in Section 4 (OPERATION). Check all panel control knobs for mechanical tightness on shafts; also check for smooth operation. Check cable connections on rear of unit and make certain all are tight and clean. If any faults are found which the operator is not authorized to correct (see paragraph 2) refer to Section 7.

2. EMERGENCY MAINTENANCE.

Notice to Operators

Operators shall not perform any of the following emergency maintenance procedures without proper authorization.

a. SCOPE. There are only three items which the operator should replace. These are the indicating lights, fuses and electron tubes. The procedure to be followed is given in Table 5–1 and subparagraphs *b, c,* and *d* below.

CAUTION

Be sure the power switch (S1) is in the OFF position when replacing indicating lights, fuses, or electron tubes, or doing work of any kind on the unit.

b. INDICATING LIGHT REPLACEMENT. — To replace the indicating lights (I1 and I2) first remove the cover plate on the rear of the unit, next remove tubes V5 and V6 (see figure 5–1), and then reach inside the unit and take out the defective lamps by turning them counterclockwise. Install new lamps; replace tubes V5 and V6, and replace rear cover.

CAUTION

Never replace a fuse with one of higher rating unless continued operation of the equipment is more important than probable damage. If a fuse burns out immediately after replacement, do not replace it a second time until the cause has been corrected.

c. FUSE REPLACEMENT.—The unit is equipped with two fuses (F1 and F2); both are located on the rear of the unit (see figure 1–3). To replace a fuse turn the cap of the fuseholder counterclockwise and pull out the fuse. Install new fuse (see NOTE below) and replace cap.

Note

If the Signal Generator SG–42/URM–18 is being operated from 105–125 volt AC, 50 or 60 cycle power supply lines use a 0.6 amp fuse; if the unit is being operated from a 210–250 volt AC, 50 to 60 cycle power line use a 0.3 amp fuse.

d. ELECTRON TUBE REPLACEMENT.—The unit is equipped with nine electron tubes as listed in Table 1–4. The location of each tube is shown in figure 5–1. When removing a tube grasp it firmly and pull straight up from the socket with a very slight rocking motion. Exercise care as excessive rocking will break off tube pins or damage the socket. When installing a tube in its socket (see NOTE below) align the tube pins to correspond with the holes in the socket and press the tube firmly into the socket.

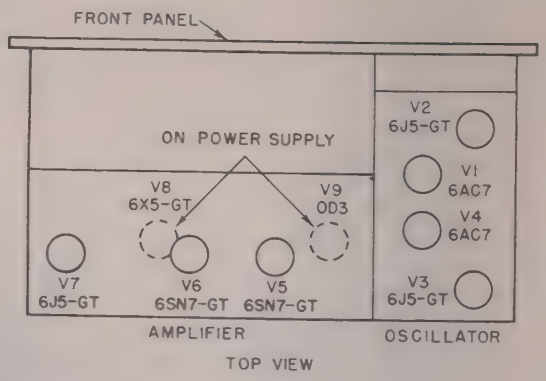


Figure 5–1. Signal Generator SG–42/URM–18, Electron Tube Locations

Note

ALL TUBES OF A GIVEN TYPE SUPPLIED WITH THE EQUIPMENT SHALL BE CONSUMED PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

TABLE 5–1. OPERATOR'S EMERGENCY CHECK CHART

TROUBLE SYMPTOM	PROBABLE CAUSE	CORRECTION
1. Power switch (S1) turned ON but indicating lights (I1 and I2) do not indicate.	Indicating lights (I1 or I2, or both) burned out.	Replace I1 or I2, or both, as necessary. Refer to par. 2*b*.
	Fuses (F1 to F2, or both) blown.	Replace F1 or F2, or both, as necessary. Refer to par. 2*c*.
	No power from supply line.	Report power failure.
2. Power switch (S1) turned ON, indicating lights I1 and I2) function, but no signal output or unsatisfactory output.	No input, or unsatisfactory input signal.	Check source of input signal and all input connections. Also check all output connections. Refer to Section 3, par. 2.
	Defective electron tubes.	Remove and check tubes one by one. Replace defective tube or tubes. Check output; refer to par. 2*d*. If unit is still inoperative, repairs are indicated. Refer to Section 7.

SECTION 6
PREVENTIVE MAINTENANCE

1. SCOPE.

a. Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair, as covered in Section 7, since its object is to prevent troubles from occuring rather than locating and correcting them.

b. The periodic mechanical and electrical checks and preventive maintenance procedures given in this section should be carefully followed in order to assure continuity of service at all times and the maintenance of the equipment at its peak performance.

2. ROUTINE CHECK CHART.

a. To accomplish the above mentioned ends a step-by-step procedure for preventive maintenance is given in Table 6–1. (Routine Maintenance Check Chart.) This table lists "What to Check," "How to Check" and "Precautions," and the prescribed periods when checking should be done (Daily, Weekly and Monthly, etc.) is indicated for each item.

b. Before starting any preventive maintenance work have on hand the needed tools and materials. These are listed in paragraph 3. Also refer to Section 5 (OPERATOR'S MAINTENANCE), and Section 7 (CORRECTIVE MAINTENANCE) in order to be familiar with the limitations of maintenance to be performed. The NOTE which follows should also be especially heeded.

Note

THE ATTENTION OF MAINTENANCE PERSONNEL IS INVITED TO THE REQUIREMENTS OF CHAPTER 67 OF THE *BUREAU OF SHIPS MANUAL* OF THE LATEST ISSUE.

3. MAINTENANCE METHODS.

a. No special tools are required for preventive maintenance of Signal Generator SG–42/URM–18 but the following items should be on hand for routine cleaning and maintaining the equipment.

1. Brush, Varnish Type	38–B–5190
2. Cloth	27–S–7670
3. Crocus Cloth	G42–C–20400
4. Solvent, Dry Cleaning Type	G51–C–1326–67
5. Pliers	G41–P–1850
6. Screwdriver	G41–S–1550–50
7. Soldering Iron	G41–I–695
8. Solder	G46–S–937

b. The Signal Generator is easily cleaned without disassembling except for the removal of the rear cover. Wipe out all dust and dirt between parts with a clean cloth. Use a dry brush to remove dust from terminal boards, switches and wiring. *Never use a damp or wet cloth to clean wiring.*

c. If dirt or corrosion exists which cannot be removed with a cloth or brush, use a cloth moistened slightly with solvent, then wipe thoroughly dry. For dirt and corrosion that cannot be removed with solvent alone, use crocus cloth; then after cleaning reclean with solvent and wipe dry.

CAUTION

Never use steel wool to clean the equipment. Minute particles may enter the unit and cause shorting of circuits.

d. If it is necessary to repair or replace any part observe the same precautions and follow the same procedures as given for replacing parts when doing corrective maintenance work (refer to Section 7, par. 6).

4. PAINTING AND RETOUCHING.

a. When the finish on the panel has become badly scarred or damaged, rust and corrosion may be prevented by touching up the bared spot with paint. To do so proceed as follows:

b. Use a #00 or #000 sandpaper to clean the surface down to bare metal and obtain a bright smooth finish. *Do not use steel wool* (see par. 3*c*). When ready to paint make reference to Bureau of Ships Manual, Chapter 19 (covering painting or retouching electronic equipment) for type of paint to use.

5. LUBRICATION.

a. Under no circumstances apply lubrication in the field to any part of Signal Generator SG–42/URM–18. To do so will result in possible damage to parts.

b. The only parts of the Signal Generator that require lubrication have been lubricated by the manufacturer prior to delivery of the equipment. These are the worm and worm gears, and drive gears. Lubrication should be done only when the equipment is being overhauled. Use a lubricant specified in MIL–G–3278.

TABLE 6-1. ROUTINE MAINTENANCE CHECK CHART

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
DAILY		
1. Operational check	*a.* Follow procedure given in Section 5.	If replacement of indicating lights, fuses, or electron tubes is necessary follow procedure given in Section 5.
2. Front panel: Controls knobs FREQUENCY dials Δf DIRECT and Δf REVERSE dials OUTPUT meter INPUT and OUTPUT jacks Power switch (see fig. 4-1)	*a.* Visually inspect front panel for dirt and corrosion. *b.* Check all six control knobs for broken or loose knobs and missing set screws. Also check for binding and scraping. *c.* Check operation of main FREQUENCY dials and Δ f dials. *d.* Check operation of OUTPUT meter. *e.* Inspect INPUT and OUTPUT jacks for corrosion and mechanical tightness. *f.* Check operation of power switch.	Clean as directed in Section 6, par. 3. Replace as necessary. Do not tighten set screws beyond a firm hold. If main FREQUENCY dials, Δ f dials, OUTPUT meter, jacks or power switch are defective replacement must be done by authorized personnel.
3. Rear of unit: Power supply jack Fuses INPUT and OUTPUT jacks	*a.* Visually inspect all three jacks for dirt and corrosion and mechanical tightness. *b.* Check fuses.	Clean as directed in Section 6, par. 5. If replacements are necessary refer to Section 7. If fuses are replaced refer to Section 5, par. 2*c* for correct rating.
WEEKLY	**CAUTION** *Disconnect all power before performing the following operations. Upon completion of work reconnect power and check for satisfactory operation*	
1. Exterior of Unit: Case and Cover Cables Power cord	*a.* Visually inspect exterior of case and cover for rust, corrosion, fungus growth and moisture. *b.* Inspect cables and power cord for signs of cuts, breaks, fraying, deterioration, kinks, fungus growth, etc.	Clean as directed in Section 6, par. 3. Clean and repair as necessary.

TABLE 6–1. ROUTINE MAINTENANCE CHECK CHART—Continued

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
2. Interior of Unit: Electron tubes Capacitors Coils Resistors Switches Terminal boards Transformer	*a.* Visually inspect interior of unit for dirt, rust, corrosion, fungus growth, and moisture.	Clean as directed in Section 6, par. 3.
	b. Inspect electron tubes for loose envelops, loose cap connectors, cracked sockets, and insufficient socket spring tension.	*Dust and clean electron tubes carefully. Be sure they are properly replaced.*
	c. Inspect all capacitors, coils, resistors, switches, terminal boards, and transformers for looseness or signs of damage.	Clean, tighten and repair all connections as needed. If any defective parts are found, replacement must be done by authorized personnel. Refer to Section 7.
MONTHLY	**CAUTION** *Disconnect all power before performing the following operations. Upon completion of work reconnect power and check for satisfactory operation*	
1. Interior of Unit: Electron tubes Capacitors Coils Resistors Switches Terminal boards Transformer	*a.* Remove and test all electron tubes monthly regardless of hours of operation. (Refer to fig. 5–1 for electron tube locations.)	Replace all defective electron tubes. Be sure new tubes are of correct type.
	b. Inspect terminals of all capacitors, resistors, and coils for corrosion and loose connections.	
	c. Inspect all fixed capacitors for leaks, bulges and discoloration.	If any parts (capacitors, coils, resistors, etc.) are found defective, replacement must be done by authorized personnel. Refer to Section 7.
	d. Inspect all variable capacitors for dirt, moisture, misalignment of plates and loose mountings.	
	e. Inspect all coils, resistors, potentiometers, rheostats and transformers for blistering, discoloration and overheating.	
	f. Inspect terminals of all capacitors, resistors, and coils for corrosion and loose connections.	

FAILURE REPORTS

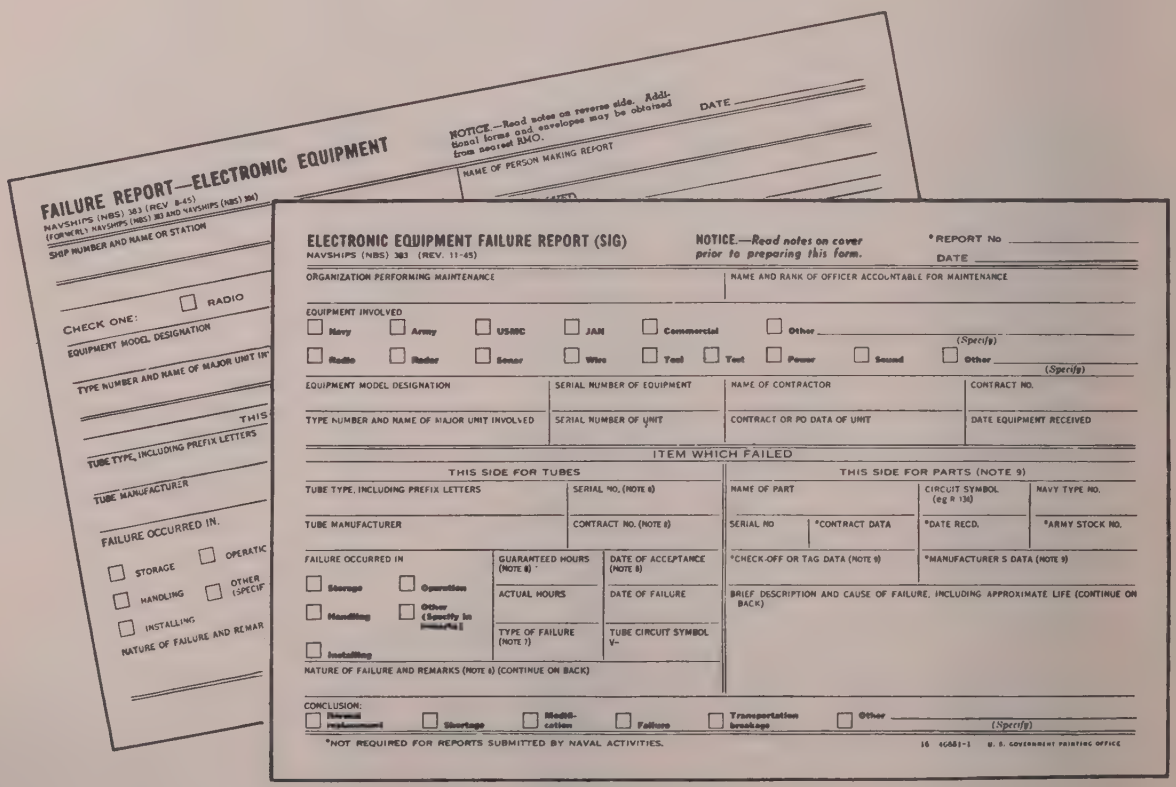
A FAILURE REPORT must be filled out for the failure of any part of the equipment whether caused by defective or worn parts, improper operation, or external influences. It should be made on Failure Report, form NBS–383, which has been designed to simplify this requirement. The card must be filled out and forwarded to BUSHIPS in the franked envelope which is provided. Full instructions are to be found on each card.

Use great care in filling the card out to make certain it carries adequate information. For example, under "Circuit Symbol" use the proper circuit identification taken from the schematic drawings, such as T–803, in the case of a transformer, or R–207, for a resistor. Do not substitute brevity for clarity. Use the back of the card to completely describe the cause of failure and attach an extra piece of paper if necessary.

The purpose of this report is to inform BUSHIPS of the cause and rate of failures. The information is used by the Bureau in the design of future equipment and in the maintenance of adequate supplies to keep the present equipment going. The cards you send in, together with those from hundreds of other ships, furnish a store of information permitting the Bureau to keep in touch with the performance of the equipment of your ship and all other ships of the Navy.

This report is not a requisition. You must request the replacement of parts through your Officer-in-Charge in the usual manner.

Make certain you have a supply of Failure Report cards, and envelopes on board. They may be obtained from the nearest District Printing and Publications Office.



FAILURE REPORT—ELECTRONIC EQUIPMENT
NAVSHIPS (NBS) 383 (REV. 8-45)
(FORMERLY NAVSHIPS (NBS) 83 AND NAVSHIPS (NBS) 384)
SHIP NUMBER AND NAME OR STATION
CHECK ONE: RADIO
EQUIPMENT MODEL DESIGNATION
TYPE NUMBER AND NAME OF MAJOR UNIT IN
TUBE TYPE, INCLUDING PREFIX LETTERS
TUBE MANUFACTURER
FAILURE OCCURRED IN.
STORAGE
OPERATIC
HANDLING
OTHER (SPECIF
INSTALLING
NATURE OF FAILURE AND REMAR
NOTICE.—Read notes on reverse side. Addi-tional forms and envelopes may be obtained from nearest RMO.
DATE
NAME OF PERSON MAKING REPORT

ELECTRONIC EQUIPMENT FAILURE REPORT (SIG)
NAVSHIPS (NBS) 383 (REV. 11-45)
NOTICE.—Read notes on cover prior to preparing this form.
*REPORT No
DATE
ORGANIZATION PERFORMING MAINTENANCE
NAME AND RANK OF OFFICER ACCOUNTABLE FOR MAINTENANCE
EQUIPMENT INVOLVED
Navy Army USMC JAN Commercial Other (Specify)
Radio Radar Sonar Wire Test Text Power Sound Other (Specify)
EQUIPMENT MODEL DESIGNATION
SERIAL NUMBER OF EQUIPMENT
NAME OF CONTRACTOR
CONTRACT NO.
TYPE NUMBER AND NAME OF MAJOR UNIT INVOLVED
SERIAL NUMBER OF UNIT
CONTRACT OR PO DATA OF UNIT
DATE EQUIPMENT RECEIVED
ITEM WHICH FAILED
THIS SIDE FOR TUBES
TUBE TYPE, INCLUDING PREFIX LETTERS
SERIAL NO. (NOTE 6)
TUBE MANUFACTURER
CONTRACT NO. (NOTE 8)
FAILURE OCCURRED IN
Storage Operation Handling Other (Specify in remarks) Installing
GUARANTEED HOURS (NOTE 8)
DATE OF ACCEPTANCE (NOTE 8)
ACTUAL HOURS
DATE OF FAILURE
TYPE OF FAILURE (NOTE 7)
TUBE CIRCUIT SYMBOL V–
NATURE OF FAILURE AND REMARKS (NOTE 6) (CONTINUE ON BACK)
THIS SIDE FOR PARTS (NOTE 9)
NAME OF PART
CIRCUIT SYMBOL (eg R 136)
NAVY TYPE NO.
SERIAL NO
*CONTRACT DATA
*DATE RECD.
*ARMY STOCK NO.
*CHECK-OFF OR TAG DATA (NOTE 9)
*MANUFACTURER'S DATA (NOTE 9)
BRIEF DESCRIPTION AND CAUSE OF FAILURE, INCLUDING APPROXIMATE LIFE (CONTINUE ON BACK)
CONCLUSION:
Normal replacement Shortage Modification Failure Transportation breakage Other (Specify)
*NOT REQUIRED FOR REPORTS SUBMITTED BY NAVAL ACTIVITIES.
16 46681-1 U. S. GOVERNMENT PRINTING OFFICE

Figure 7–1. Failure Report, Sample Form

SECTION 7
CORRECTIVE MAINTENANCE

1. FAILURE REPORTS.

a. Whenever corrective maintenance work is done a Failure Report must be made. The report form to be used is shown in figure 7–1. When making out this report follow the procedure given in the Trouble Shooting Chart (Table 7–1).

2. THEORY OF LOCALIZING TROUBLE.

a. Failure of Signal Generator SG–42/URM–18 to operate properly will usually be caused by one or more of the following faults:

(1) Failure of power supply line.

(2) Worn, broken, or disconnected power cable, interconnecting cables, or patch cords.

(3) Burned out fuses.

(4) Defective or burned out electron tubes.

(5) Internal wiring broken because of vibration or corrosion.

Accordingly, when failure occurs and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the circuits and parts of the unit. If possible obtain from the operator of the equipment information regarding performance at the time trouble occured.

b. Before attempting to perform any corrective maintenance the repairman should, of course, be thoroughly familiar with the theory of operation and the operation of the unit. The Signal Generator SG–42/URM–18 is fully described in Section 1; the theory of its operation is presented in Section 2, and operation is covered in Section 4. In addition to the procedure outlined in this section for corrective maintenance the repairman should also familiarize himself with Operator's Maintenance (Section 5) and Preventive Maintenance (Section 6).

3. TROUBLE SHOOTING CHART.

a. Shown in block form in Table 7–1 is a Trouble Shooting Chart for Signal Generator SG–42/URM–18. The various sections or stages of the unit where trouble may occur are shown in heavy outline blocks. In the blocks to the left and below the heavy blocks are listed the trouble symptoms and the parts or components which are probably at fault.

b. By following the indicated procedure of the Trouble Shooting Chart the faulty or defective part can be located by following the usual testing methods used for electronic equipment, with the majority of faults best localized by checking voltage and resistance measurements.

c. When trouble shooting is done the repairman may frequently discover the trouble, or determine the stage in which trouble exists, through visual inspection alone. Some faults, such as burned-out resistors, r-f arcing, and shorted transformers can often be located by sight, smell or hearing. Listen for crackling or buzzing noises which indicate high-voltage arcing. Check the unit for smoke and the odor of burned or overheated parts. Visual inspection is also valuable in avoiding additional damage to the equipment which might occur through improper servicing methods and in forestalling future failures.

CAUTION

The Main Tuning Capacitor assembly, shown in figures 7–7 and 7–8, is calibrated at the factory and cannot be repaired in the field. Do not attempt to disassemble the unit. If damaged replace with a complete new assembly.

4. GENERAL TROUBLE SHOOTING PRECAUTIONS.

a. When servicing work is done carefully observe the following precautions:

(1) *Observe all safety precautions when handling units where high voltages are used. Carelessness can result in death or serious injury. Be sure capacitors are discharged before handling them. Make certain the unit is disconnected both from power supply lines and all other units.*

(2) Before removing a part, first tag or mark it so that when replaced, or another new part replaces it, the proper connections will be made. This is especially important whenever transformers are removed.

(3) When unsoldering is done be careful not to allow drops of solder to fall into the unit, since they may cause short circuits. This same precaution should, or course, be observed when resoldering is done.

(4) When resoldering, be certain a well-soldered joint is made. A carelessly soldered joint may easily create a new fault, for a poorly soldered joint is one of the most difficult faults to find.

(5) Careless removal and replacement of parts often makes new faults inevitable. Push or pull other leads out of the way only when necessary and then do so carefully.

(6) Be certain all screw-type connections make good electrical contact; also be sure all mechanical connections are tight.

b. Whenever a new part is placed in an r-f circuit, be certain it is *electrically and mechanically* identical with the part it replaces; and is *placed in exactly the same position* as the original part. This is very important since a replaced part which has the same electrical value but differs in physical size and shape may cause trouble in high frequency circuits.

c. Give particular attention to proper grounding when a part is replaced. Always use the same ground as in the original wiring. Failure to observe this precaution may result in gain or possible oscillation of the circuit.

5. TROUBLE SHOOTING DATA.

a. The illustrations, drawings, and tables appearing at the end of the section should be referred to when doing corrective maintenance work. A diagram showing tube socket voltages and resistances is given in figure 7–2. Figures 7–3 thru 7–8 show the location of the various parts of the equipment. The schematic diagram of the unit is given in figure 7–9.

b. Electron tube operating voltages and currents are given in Table 7–2; tube rated characteristics data will be found in Table 7–3.

c. R-F and A-F voltages at coils and electron tubes are given in Table 7–4. Transformer and coil resistances will be found in Table 7–5. Winding data for both coils and transformers is given in Table 7–6.

6. EQUIPMENT REQUIRED FOR ALIGNMENT AND TESTING.

a. Following any repair or general servicing of Signal Generator SG–42/URM–18 the unit should be aligned and given a final test to be certain its operating performance is correct and accurate. The procedure for such work is given in paragraph 7.

b. The equipment required for alignment and final testing is listed in Table 1–2.

7. ALIGNMENT PROCEDURES AND FINAL TESTING.

a. Since the Signal Generator SG–42/URM–18 can be quickly and easily calibrated as used, minor changes in the dial calibration are of little importance. The circuits are quite stable and ordinarily require realignment only at very infrequent intervals.

b. To realign zero of the Δ f (and zero set dials) proceed as follows:

(1) Place Signal Generator SG–42/URM–18 and Oscilloscope OS–8/U, Navy Model OBL or OBT Series (see Table 1–2) in operation.

(2) On the Oscilloscope select a 1-kc circular sweep frequency.

(3) Set the Signal Generator to *exactly* 2500 divisions.

(4) Adjust output of the Signal Generator to get reasonable radial deflection on the Oscilloscope.

(5) With the REVERSE-DIRECT switch (S2), on the Signal Generator, set to DIRECT and the Δf DIRECT dial (N4) set at zero, adjust the trimmer capacitor C10 (under snap cover H2 on front panel) for the DIRECT dial to make the pattern on the Oscilloscope as nearly stationary as possible.

(6) Adjust the Δ f DIRECT dial to make pattern stationary and note residual error from zero on dial. If within $\pm$ one cycle the adjustment is correct.

(7) Repeat steps (1) thru (6) with the REVERSE-DIRECT switch set to REVERSE adjusting zero of Δ f REVERSE dial N3 by using trimmer capacitor C8 (under snap cover H1 on front panel).

Note

ALL TUBES OF A GIVEN TYPE SUPPLIED WITH THE EQUIPMENT SHALL BE CONSUMED PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

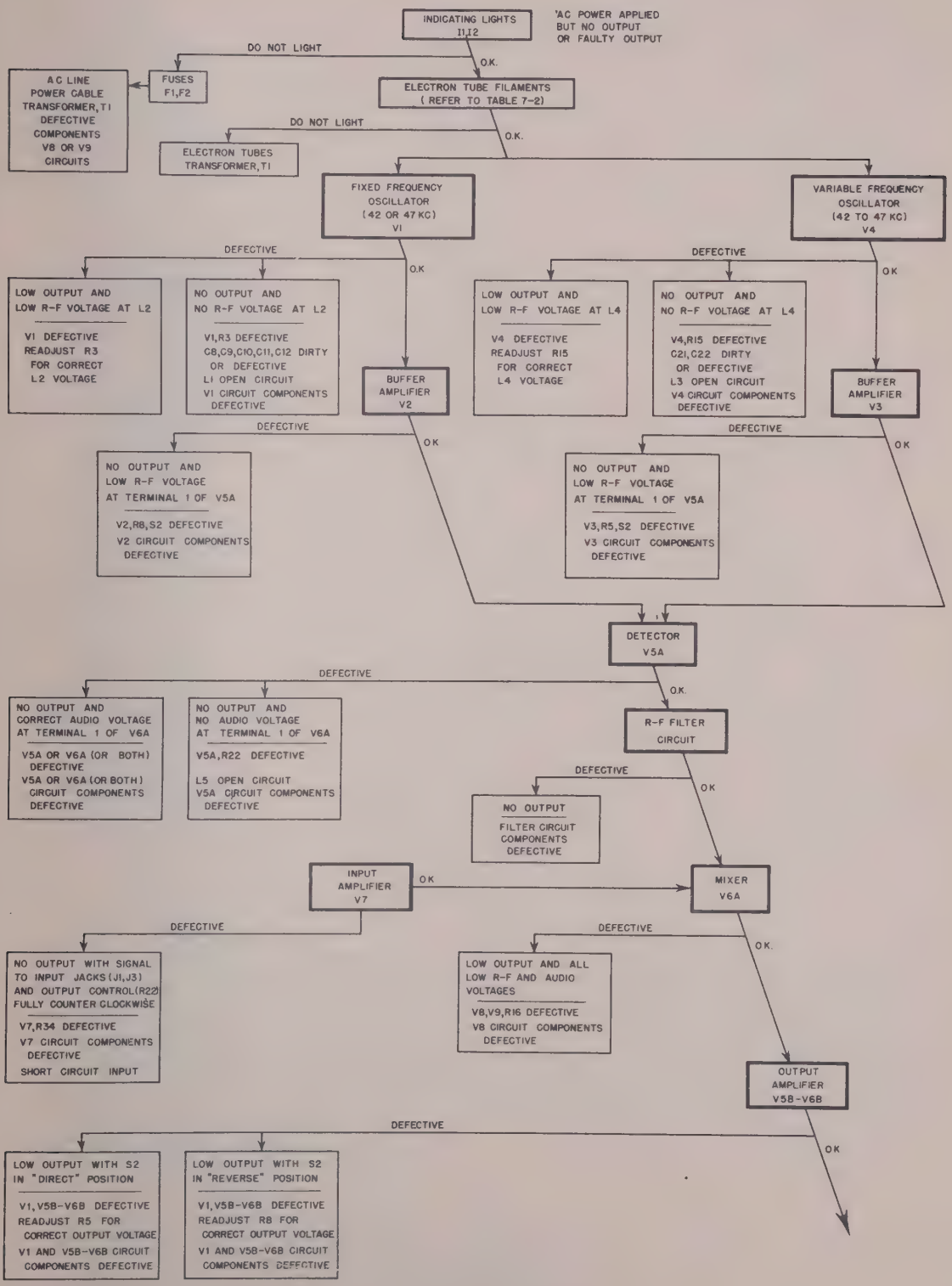
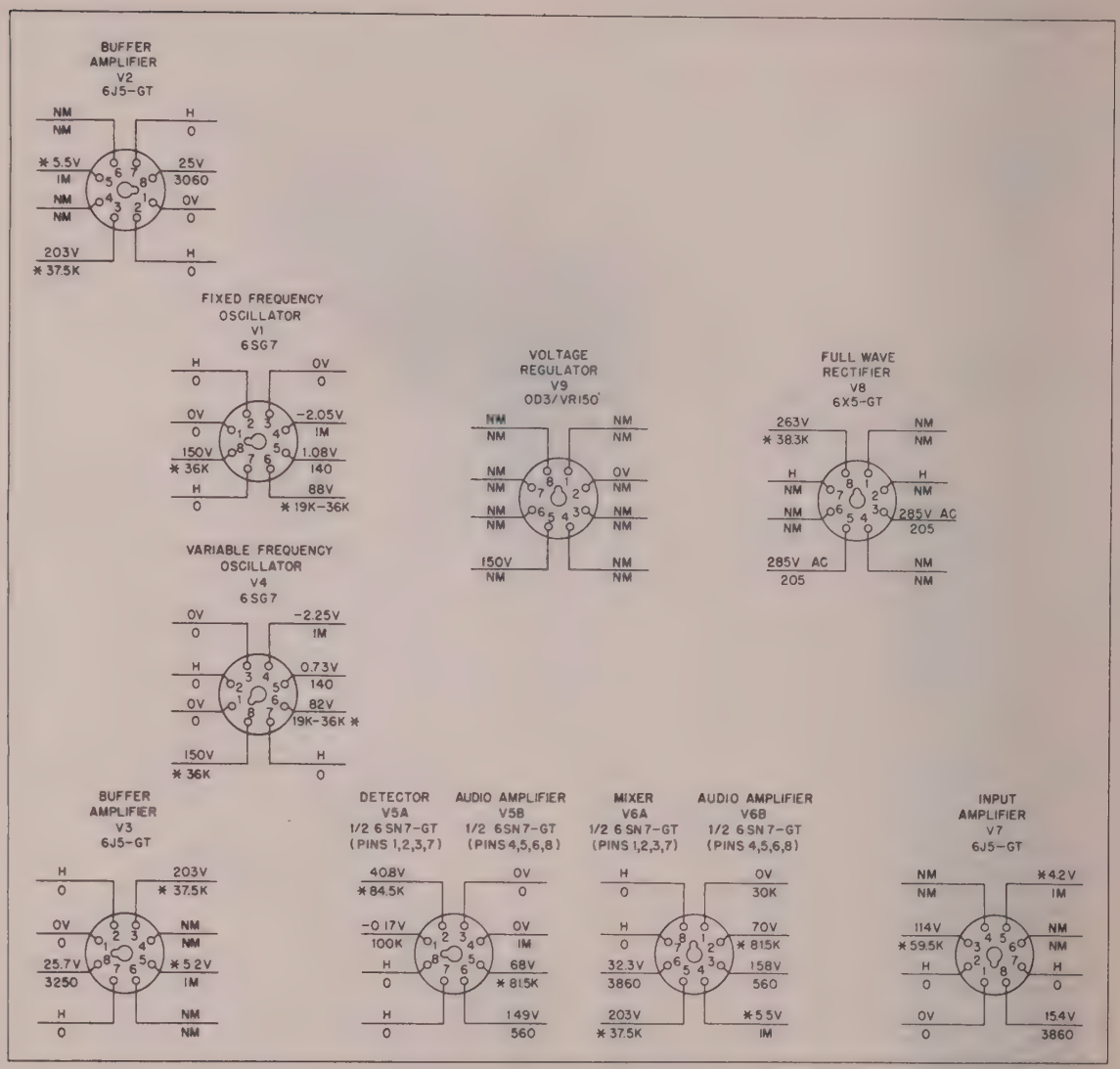

INDICATING LIGHTS I1,I2
*AC POWER APPLIED BUT NO OUTPUT OR FAULTY OUTPUT
DO NOT LIGHT
O.K.
AC LINE POWER CABLE TRANSFORMER,T1 DEFECTIVE COMPONENTS V8 OR V9 CIRCUITS
FUSES F1,F2
ELECTRON TUBE FILAMENTS (REFER TO TABLE 7-2)
DO NOT LIGHT
O.K.
ELECTRON TUBES TRANSFORMER,T1
FIXED FREQUENCY OSCILLATOR (42 OR 47 KC) V1
VARIABLE FREQUENCY OSCILLATOR (42 TO 47 KC) V4
DEFECTIVE
O.K
LOW OUTPUT AND LOW R-F VOLTAGE AT L2
V1 DEFECTIVE READJUST R3 FOR CORRECT L2 VOLTAGE
NO OUTPUT AND NO R-F VOLTAGE AT L2
V1,R3 DEFECTIVE C8,C9,C10,C11,C12 DIRTY OR DEFECTIVE L1 OPEN CIRCUIT V1 CIRCUIT COMPONENTS DEFECTIVE
BUFFER AMPLIFIER V2
LOW OUTPUT AND LOW R-F VOLTAGE AT L4
V4 DEFECTIVE READJUST R15 FOR CORRECT L4 VOLTAGE
NO OUTPUT AND NO R-F VOLTAGE AT L4
V4,R15 DEFECTIVE C21,C22 DIRTY OR DEFECTIVE L3 OPEN CIRCUIT V4 CIRCUIT COMPONENTS DEFECTIVE
BUFFER AMPLIFIER V3
NO OUTPUT AND LOW R-F VOLTAGE AT TERMINAL 1 OF V5A
V2,R8,S2 DEFECTIVE V2 CIRCUIT COMPONENTS DEFECTIVE
NO OUTPUT AND LOW R-F VOLTAGE AT TERMINAL 1 OF V5A
V3,R5,S2 DEFECTIVE V3 CIRCUIT COMPONENTS DEFECTIVE
DETECTOR V5A
NO OUTPUT AND CORRECT AUDIO VOLTAGE AT TERMINAL 1 OF V6A
V5A OR V6A (OR BOTH) DEFECTIVE V5A OR V6A (OR BOTH) CIRCUIT COMPONENTS DEFECTIVE
NO OUTPUT AND NO AUDIO VOLTAGE AT TERMINAL 1 OF V6A
V5A,R22 DEFECTIVE L5 OPEN CIRCUIT V5A CIRCUIT COMPONENTS DEFECTIVE
R-F FILTER CIRCUIT
NO OUTPUT
FILTER CIRCUIT COMPONENTS DEFECTIVE
INPUT AMPLIFIER V7
MIXER V6A
NO OUTPUT WITH SIGNAL TO INPUT JACKS (J1,J3) AND OUTPUT CONTROL (R22) FULLY COUNTER CLOCKWISE
V7,R34 DEFECTIVE V7 CIRCUIT COMPONENTS DEFECTIVE SHORT CIRCUIT INPUT
LOW OUTPUT AND ALL LOW R-F AND AUDIO VOLTAGES
V8,V9,R16 DEFECTIVE V8 CIRCUIT COMPONENTS DEFECTIVE
OUTPUT AMPLIFIER V5B-V6B
LOW OUTPUT WITH S2 IN "DIRECT" POSITION
V1,V5B-V6B DEFECTIVE READJUST R5 FOR CORRECT OUTPUT VOLTAGE V1 AND V5B-V6B CIRCUIT COMPONENTS DEFECTIVE
LOW OUTPUT WITH S2 IN "REVERSE" POSITION
V1,V5B-V6B DEFECTIVE READJUST R8 FOR CORRECT OUTPUT VOLTAGE V1 AND V5B-V6B CIRCUIT COMPONENTS DEFECTIVE

Table 7-1. Trouble Shooting Chart for Signal Generator SG-42/URM-18



NOTES

VOLTAGE MEASUREMENTS

1. ALL D-C MEASUREMENTS ARE BETWEEN THE SOCKET TERMINAL AND GROUND (CHASSIS) WITH THE TUBE OPERATING EXCEPT FOR THE HEATERS WHICH ARE MEASURED BETWEEN THE TERMINALS INDICATED "H" TO BE 6.3 VOLTS A-C. LINE VOLTAGE - 117 VOLTS, INPUT POWER - 56 WATTS.
2. SET MAIN FREQUENCY DIAL TO THE 100-CYCLE POINT.
3. SET REVERSE-DIRECT SWITCH (S2) TO DIRECT.
4. SET INPUT CONTROL (R34) AND OUTPUT CONTROL (R22) COUNTERCLOCKWISE.
5. D-C VOLTAGES ARE MEASURED WITH A 20,000-OHMS-PER-VOLT METER AND A-C VOLTAGES WITH A 1,000-OHMS-PER-VOLT METER, VALUES STARRED (*) ARE READ ON THE 50-VOLT RANGE ON VOLT METER.
6. ALL READINGS ARE SUBJECT TO 10 PERCENT VARIATION.
7. NM INDICATES NOT MEASURED.

RESISTANCE MEASUREMENTS

1. ALL MEASUREMENTS MADE BETWEEN SOCKET TERMINAL AND GROUND (CHASSIS) WITH TUBE REMOVED.
2. REVERSE-DIRECT SWITCH (S2) ON DIRECT.
3. OUTPUT CONTROL (R22) CLOCKWISE.
4. VALUES ARE IN OHMS, K = KILOHMS, M = MEGOHMS.
5. READINGS SUBJECT TO 10 PERCENT VARIATION EXCEPT WHERE STARRED (*).
6. VALUES STARRED (*) ARE READ AFTER THE OHMMETER HAS STOPPED DRIFTING THE OHMMETER LEADS MUST THEN BE REVERSED, AND THE HIGHER OF THE TWO READINGS MUST BE USED BECAUSE OF LARGE CAPACITORS IN THE CIRCUIT. THESE VALUES ARE SUBJECT TO 20 PERCENT VARIATION.
7. NM INDICATES NOT MEASURED.

Figure 7-2. Signal Generator SG-42/URM-18, Tube Socket Voltages and Resistances

TABLE 7–2. TUBE OPERATING VOLTAGES AND CURRENTS

TUBE TYPE	FUNCTION	PLATE (V)	PLATE (MA)	SCREEN (V)	SCREEN (MA)	SUPP (V)	CATH (V)	GRID (V)	HEATER (V)
6AC7	Fixed frequency oscillator 42 or 47 kv (V1)	150	3.28	88	0.93	0	1.08	−2.05	6.3
6J5–GT	Buffer amplifier (V2)	203	8.03	—	—	—	25	−5.5 *	6.3
6AC7	Variable frequency oscillator 42 to 47 kc (V4)	150	4.13	82	1.07	0	0.73	−2.25	6.3
6J5–GT	Buffer amplifier (V3)	203	8.03	—	—	—	25	−5.5 *	6.3
1/2 6SN7–GT	Detector (V5A)	40.8	2.75	—	—	—	—	− .17	6.3
1/2 6SN7–GT	Mixer (V6A)	70	3.08	—	—	—	1.58	0	6.3
6J5–GT	Input amplifier (V7)	114	3.82	—	—	—	15.4	−4.2	—
1/2 6SN7–GT	Output amplifier (V5B)	68	2.90	—	—	—	1.49	0	—
1/2 6SN7–GT	Output amplifier (V6B)	203	8.12	—	—	—	32.3	−5.5 *	—
6X5–GT	Full-wave rectifier (V8)	285AC 285AC	— —	— —	— —	— —	263v DC 75.5 ma AC	—	6.3
OD3/VR150	Voltage regulator (V9)	150	—	—	—	—	—	—	—

The measurements given in this table were made under the following conditions:
(1) Main FREQUENCY dial set to 100 cycle.
(2) REVERSE-DIRECT switch set to DIRECT.
(3) INPUT control (R34) and OUTPUT control (R22) set counterclockwise.
(4) All d-c measurements, except for heaters, are between the socket terminal and ground (chassis) with the tube operating. Line voltage 117 volts; input power 56 watts.
(5) D-C voltages measured with a 20,000-ohms-per-volt meter. A-C voltages measured with a 1000-ohm-per-volt meter. Values starred (*) are read on 50-volt range on voltmeter. All readings subject to ±10 per cent variation.

TABLE 7–3. TUBE RATED CHARACTERISTIC DATA

TUBE TYPE	FILAMENT VOLTAGE (V)	FILAMENT CURRENT (A)	PLATE VOLTAGE (V)	GRID BIAS (V)	SCREEN VOLTAGE (V)	PLATE CURRENT (MA)	SCREEN CURRENT (MA)	A.C. PLATE RESISTANCE (OHMS)	VOLTAGE AMPLIFICATION FACTOR (MU)	TRANSCONDUCTANCE (MICROMHOS)		EMISSION	
										NORMAL	MINIMUM	IS (MA)	TEST VOLT
6AC7	6.3	0.3	250	− 2.5	150	9.2	3.4	1,000,000+	4000	4000	3300	—	—
6J5–GT	6.3	0.3	250	−18	—	9.0	—	7700	20	2600	2200	—	—
6SN7–GT (a)	6.3	0.6	250	− 8	—	9.0	—	7700	20	2600	2200	—	—
6X5–GT	6.3	0.6	325	—	—	70.0	—	—	—	—	—	—	—
OD3–VR150	—	—	150	—	—	5–40	—	—	—	—	—	—	—

(a) Triode.

TABLE 7–4. R-F AND A-F VOLTAGES AT COILS AND TUBES

COIL OR TUBE	TERMINAL	VOLTS*	FREQUENCY
L2	Ungrounded	2.5	42 or 47 kc
L4	Ungrounded	2.5	42 to 47 kc
V5	1	0.48	Both oscillators together
V6	1	0.135	Audio
V5	4	1.67	Audio
V6	4	15.8	Audio
	OUTPUT	14.0	Audio

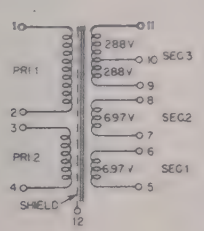
* Measurements made with an electron tube voltmeter and controls set as follows:
(1) FREQUENCY dial to 2500.
(2) DIRECT-REVERSE switch (S2), on either DIRECT or REVERSE; voltages should agree reasonably well on both positions.
(3) OUTPUT control (R22) fully clockwise.
(4) Ground low terminal to chassis. Use short leads.

TABLE 7–5. TRANSFORMER AND COIL RESISTANCES

TRANSFORMER	TERMINALS	OHMS
T1	1 to 4	8.8 *
	1 to 4	35.2 **
	5 to 6	0.4
	7 to 8	0.1
	9 to 10	189.0
	10 to 11	206.0
L1		14
L2		140
L3		14
L4		140
L5		42

* 115-volt wiring.
** 230-volt wiring.

TABLE 7–6. WINDING DATA

DESIG-NATION SYMBOL	PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D. C. RESIST-ANCE IN OHMS	IMPEDANCE RATIO	HIPOT A-C VOLTS	REMARKS
L1 L3	1107–26		3 pies wound on ceramic form with Universal Winding Machine	61 strands No. 44ES Litz	897 turns in 3 pies of 299 turns each; continuous winding	14	—	—	Filter choke inductance 11.4 mh.
L2 L4	379R		Band wound on wooden form in 3 sections; 1800 turns first section; 750 turns second section; 650 turns third section	No. 34E copper wire	3200 turns	140	—	—	Filter choke inductance 60 mh.
L5	119–A		Band wound on bakelite tube form, in one section	No. 36E copper wire	4300 turns	450	—	—	250 mh at 50 kc, unshielded, no core. Coil must have a "Q" of 50 or greater and a resonating capacitance of 46 mmf or less
T1	485–439–2		*Pri. 1* copper wire *Pri. 2* copper wire *Sec. 1* copper wire *Sec. 2* copper wire *Sec. 3* copper wire	*Pri. 1* No. 28E *Pri. 2* No. 28E *Sec. 1* No. 23E *Sec. 2* No. 20E *Sec. 3* No. 33E	*Pri. 1* 660 turns *Pri. 2* 660 turns *Sec. 1* 40 turns *Sec. 2* 40 turns of two No. 20E wire *Sec. 3* 3300 turns tapped at 1650	Terminal 1 to 4: 8.8 ohms for 115v wiring; 35.2 ohms for 230v wiring Terminal 5 to 6: 0.4 ohms Terminal 7 to 8: 0.1 ohms Terminal 9 to 10: 189 ohms Terminal 10 to 11: 206 ohms			Input: 115 or 230 volt AC, single phase, 50–60 cycles (see fig. 7–9 for proper connections). Between layers of Pri. 1 and Pri. 2 wind .002 in. M.C. Kraft paper. Between Primary and Secondary windings wind a discontinuous electrostatic shield of .002 in. copper. Between Sec. 2 and Sec. 3 wind four turns of .004 in. M.C. Kraft paper. All leads to be copper tabs .010 in. x 1/16 in. x 5 in. lg. except that Sec. 2 may have self leads.

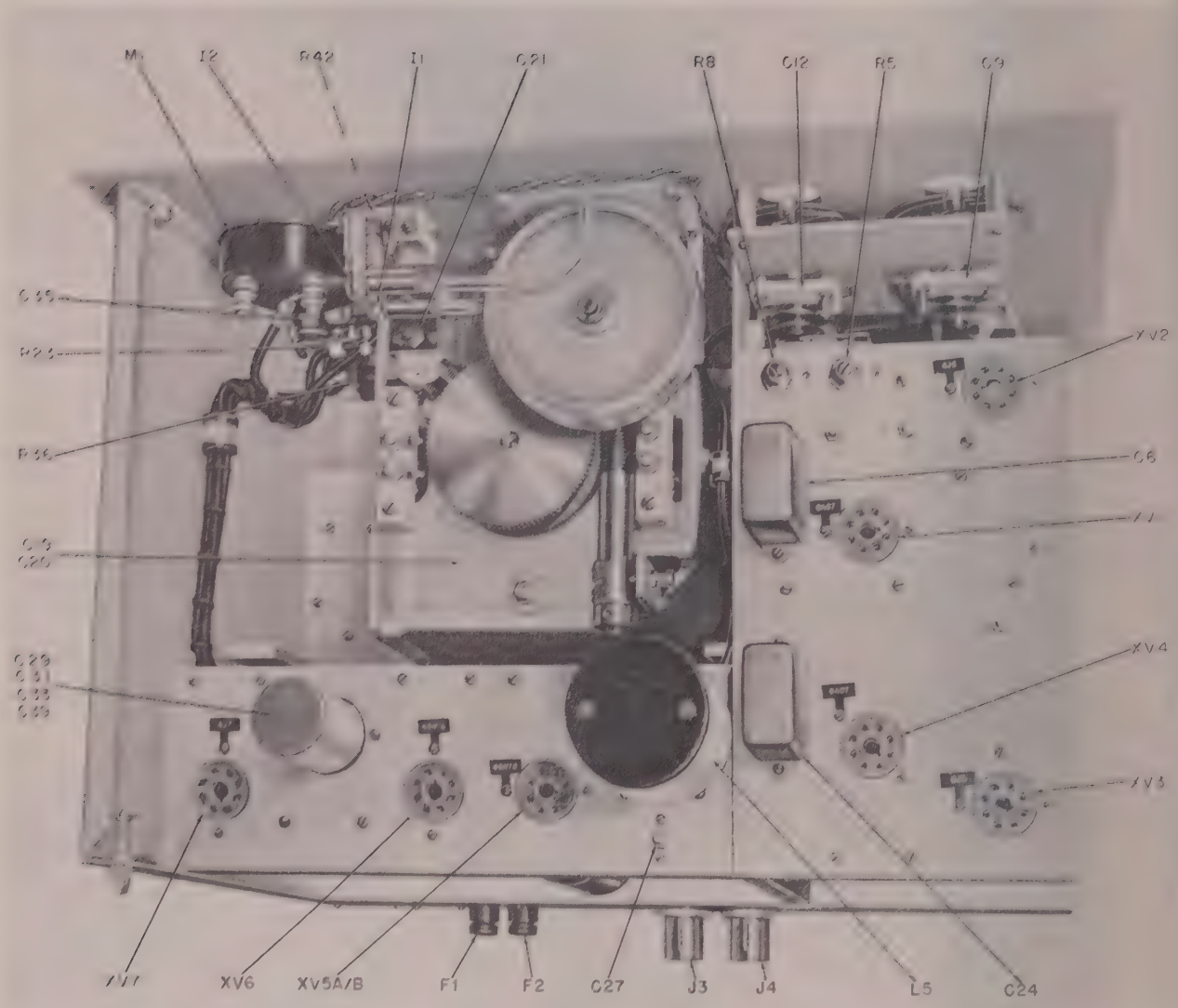


Figure 7–3. Signal Generator SG–42/URM–18, Top View of Chassis

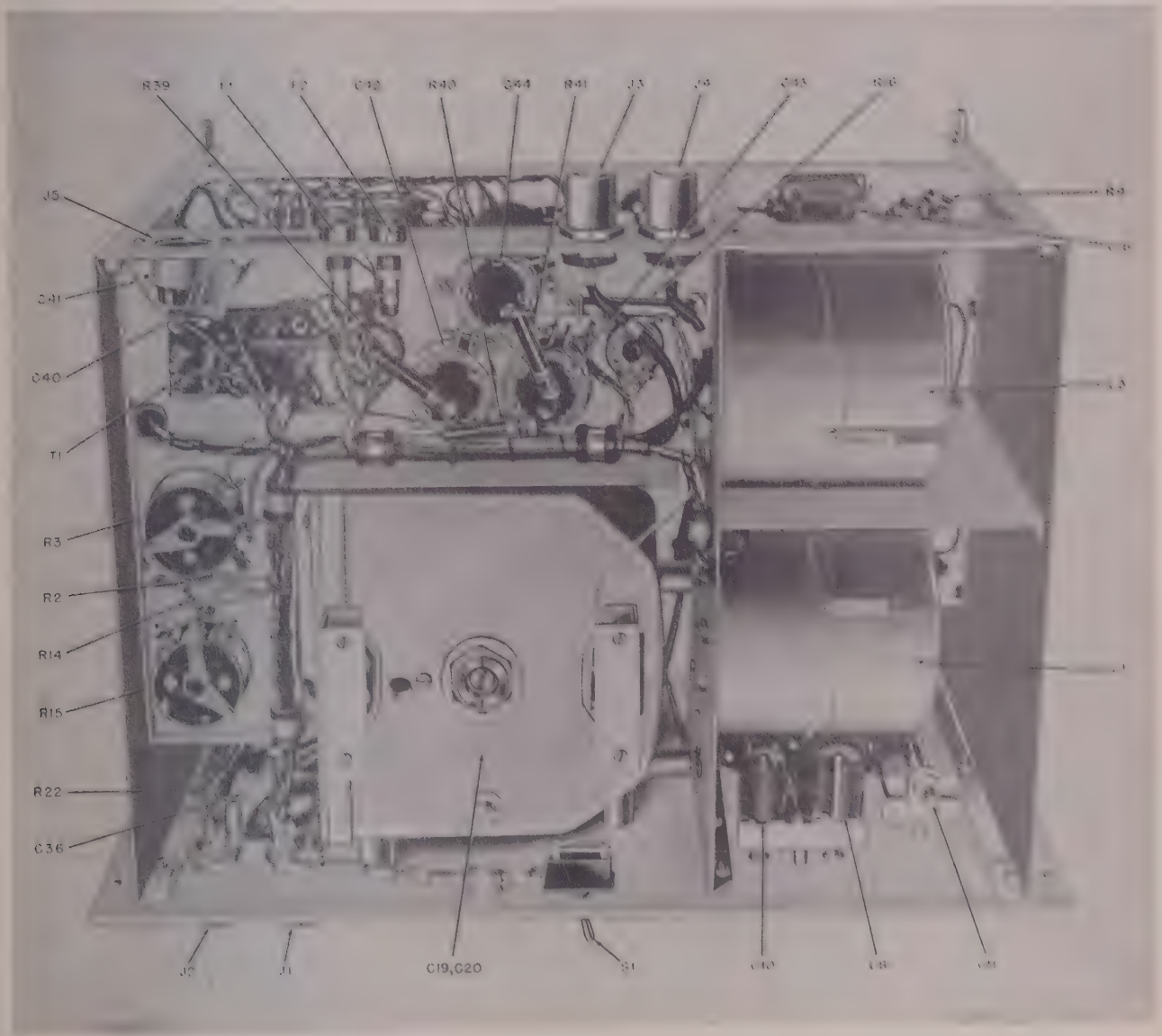


Figure 7–4. Signal Generator SG–42/URM–18, Bottom View of Chassis

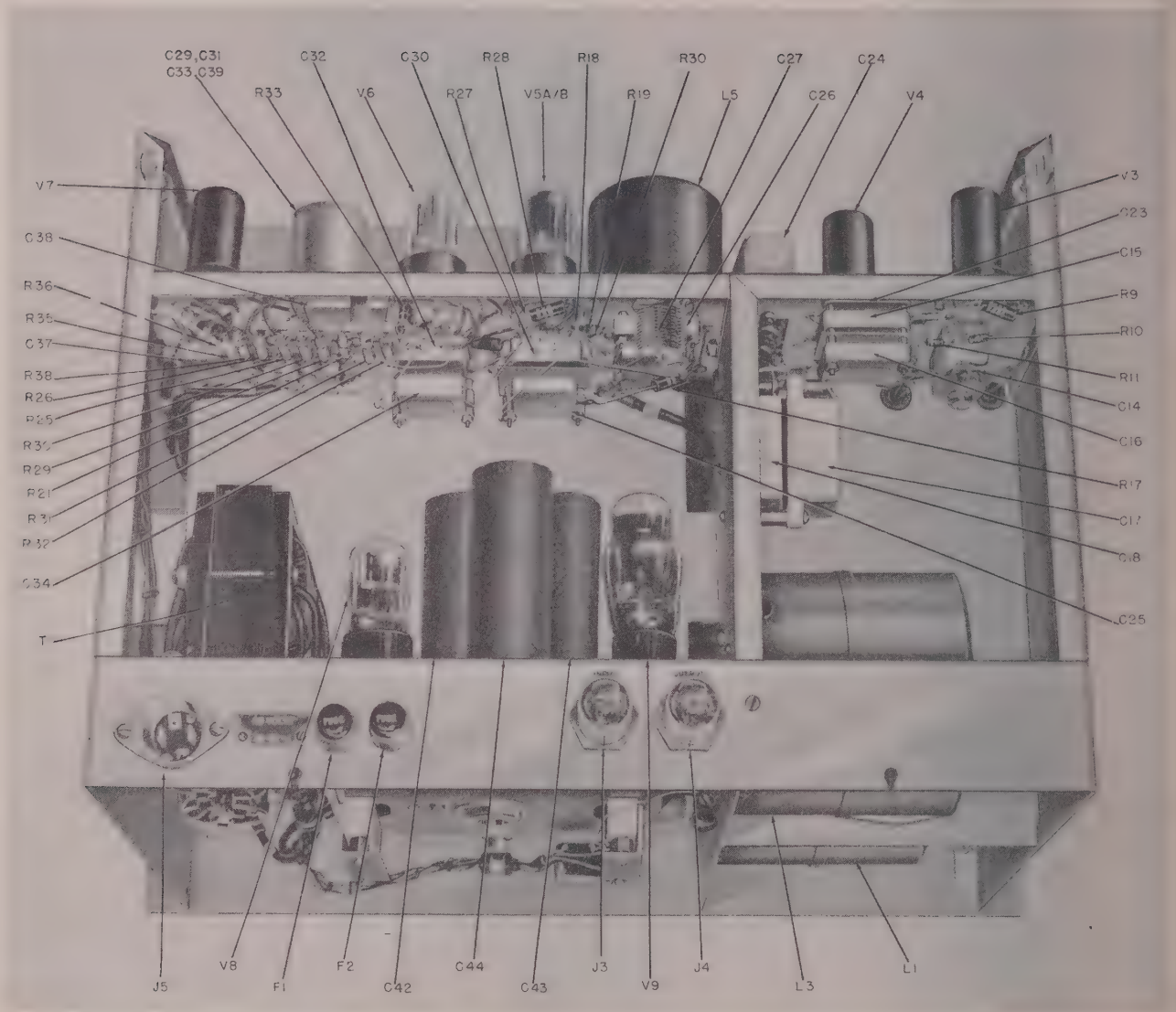


Figure 7–5. Signal Generator SG–42/URM–18, Rear View of Chassis

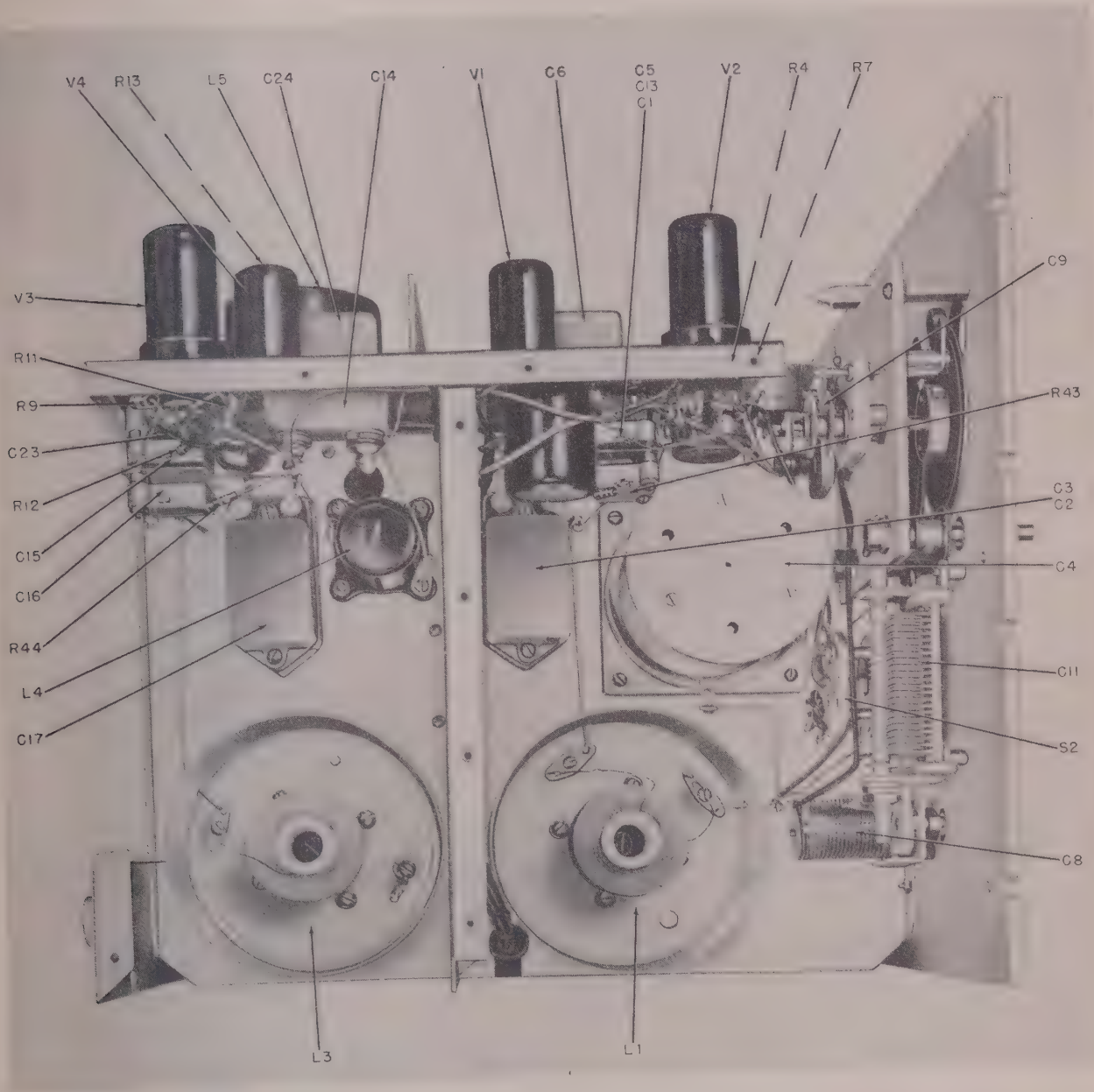


Figure 7–6. Signal Generator SG–42/URM–18, Left-side View of Chassis

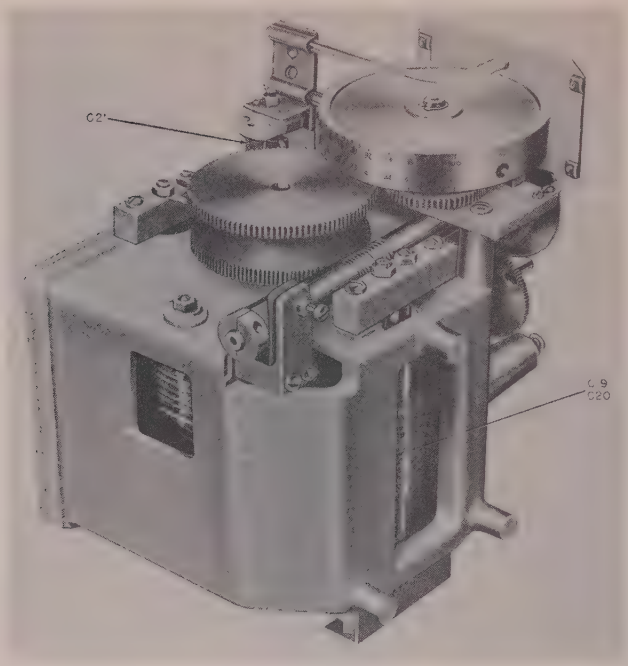


Figure 7–7. Signal Generator SG–42/URM–18, Main Tuning Capacitor Assembly, Rear View

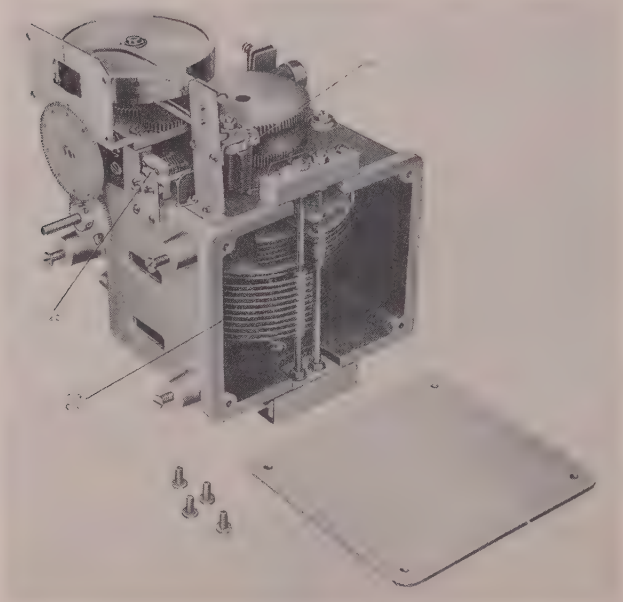


Figure 7–8. Signal Generator SG–42/URM–18, Main Tuning Capacitor Assembly, Front Side View

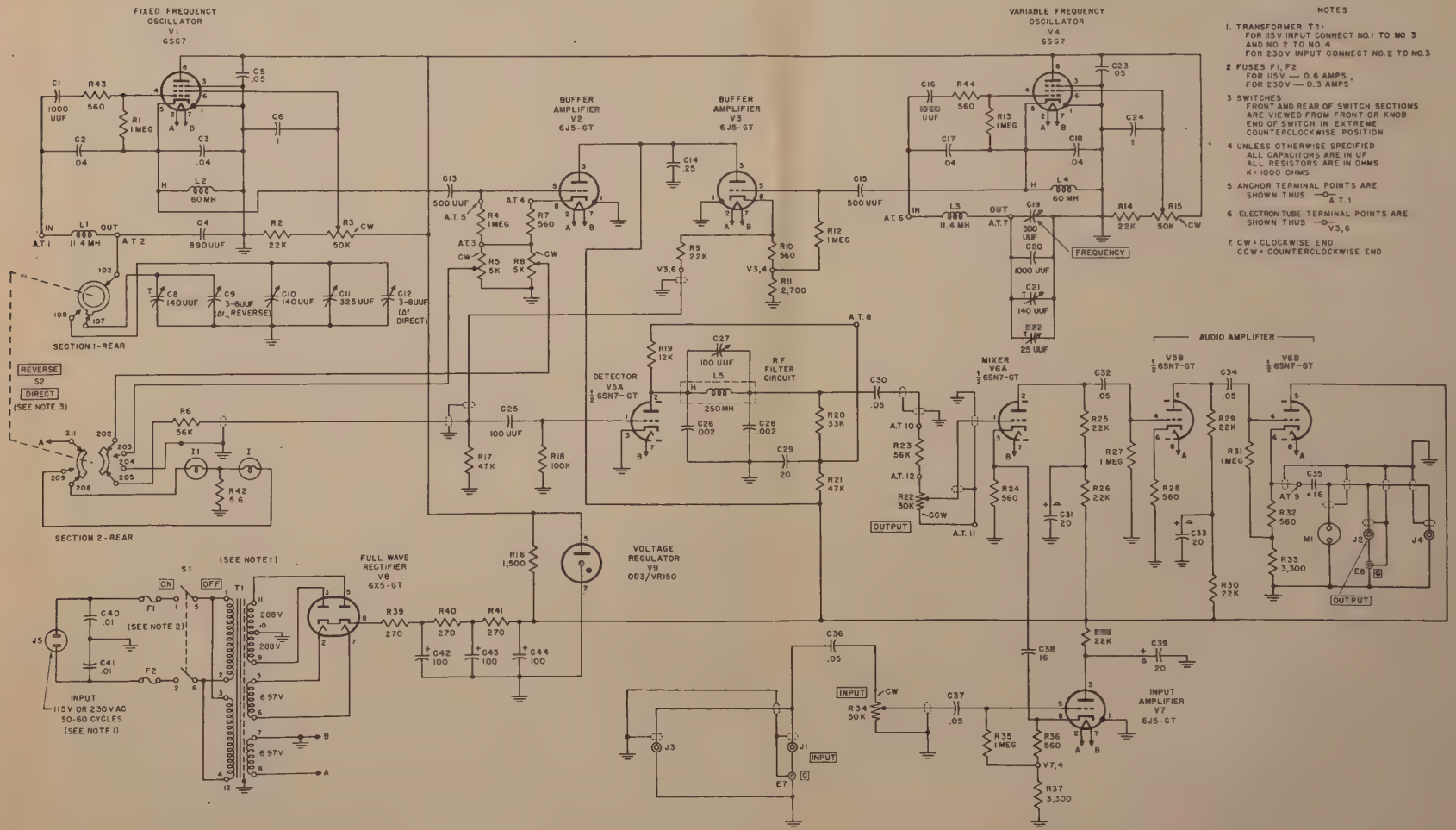

FIXED FREQUENCY OSCILLATOR V1 6SG7
BUFFER AMPLIFIER V2 6J5-GT
BUFFER AMPLIFIER V3 6J5-GT
VARIABLE FREQUENCY OSCILLATOR V4 6SG7
NOTES
1. TRANSFORMER T1:
FOR 115 V INPUT CONNECT NO.1 TO NO 3 AND NO. 2 TO NO. 4
FOR 230 V INPUT CONNECT NO.2 TO NO.3
2 FUSES F1, F2
FOR 115V — 0.6 AMPS
FOR 230V — 0.3 AMPS
3 SWITCHES
FRONT AND REAR OF SWITCH SECTIONS ARE VIEWED FROM FRONT OR KNOB END OF SWITCH IN EXTREME COUNTERCLOCKWISE POSITION
4 UNLESS OTHERWISE SPECIFIED:
ALL CAPACITORS ARE IN UF
ALL RESISTORS ARE IN OHMS
K = 1000 OHMS
5 ANCHOR TERMINAL POINTS ARE SHOWN THUS — A T. 1
6 ELECTRON TUBE TERMINAL POINTS ARE SHOWN THUS — V3,6
7 CW = CLOCKWISE END
CCW = COUNTERCLOCKWISE END
SECTION 1-REAR
SECTION 2-REAR
REVERSE
S2
DIRECT
(SEE NOTE 3)
DETECTOR V5A 1/2 6SN7-GT
RF FILTER CIRCUIT
MIXER V6A 1/2 6SN7-GT
AUDIO AMPLIFIER
V5B 1/2 6SN7-GT
V6B 1/2 6SN7-GT
FREQUENCY
OUTPUT
INPUT
INPUT AMPLIFIER V7 6J5-GT
VOLTAGE REGULATOR V9 OD3/VR150
FULL WAVE RECTIFIER V8 6X5-GT
(SEE NOTE 1)
(SEE NOTE 2)
INPUT 115V OR 230V AC 50-60 CYCLES (SEE NOTE 1)

Figure 7–9. Signal Generator SG–42/URM–18, Schematic Diagram

SECTION 8
PARTS LIST

This section contains the following tables:

Table 8–1. Shipping Weights and Dimensions of Spare Parts Boxes.
Table 8–2. List of Major Units.
Table 8–3. Table of Replaceable Parts.
Table 8–4. Applicable Color Codes and Miscellaneous Data.

TABLE 8-1. SHIPPING WEIGHTS AND DIMENSIONS OF SPARE PARTS BOXES

EQUIPMENT SPARES							STOCK SPARES						
SHIPPING BOX NUMBER	SPARE PARTS BOX	OVERALL DIMENSIONS			VOLUME	WEIGHT	SHIPPING BOX NUMBER	SPARE PARTS	OVERALL DIMENSIONS			VOLUME	WEIGHT
		HEIGHT	WIDTH	DEPTH					HEIGHT	WIDTH	DEPTH		

TABLE 8-2. LIST OF MAJOR UNITS

SYMBOL GROUP	QUANTITY	NAME OF MAJOR UNIT	NAVY TYPE	DESIGNATION
	105 to 125 V AC (or 210 to 250 V AC)			
1-99	51	Signal Generator	SG-42/URM-18	

TABLE 8–3. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STOCK NUMBERS	NAME AND DESCRIPTION	LOCATING FUNCTIONS
A1	16–B–300001–184	BEZEL: black bakelite; circular shape, 1-7/8 in. dia, 3/32 in. thick; mounts by two 0.128 in. dia holes spaced 180 deg apart and 1.625 in. C to C. General Radio Co, Part/Dwg No. ES–3.	Bezel for Δf REVERSE window A2.
A2	16–W–63685–5789	WINDOW, LIGHT: plexiglass; round shape, 1-3/8 in. dia, 0.040 in. thick; mounted in bezel A1. General Radio Co, Dwg No. WII–2.	Used as a window.
A3		Same as A1.	Bezel for Δf DIRECT window light A4
A4		Same as A2.	Used as a window.
A5	16–W–63698–2459	WINDOW, LIGHT: plexiglass; rectangular shape, 4 in. lg, 3 in. wide, 0.060 in. thick; mounted by four 0.161 in. dia holes on 3-5/8 in. by 2-5/8 in. centers. General Radio Co, Dwg No. WII–5.	Used as a window.
C1	N16–C–31091–6114	CAPACITOR, FIXED, MICA DIELECTRIC: 1000 mmf, ±10%, 2500 v DC; molded low-loss bakelite; 1-5/8 in. lg, 1-1/8 in. high, 23/64 in. deep. Cornell Dubilier Electric Corp, Type No. 4L–52010.	Fixed oscillator grid capacitor.
C2	16–C–34983–3554	CAPACITOR, FIXED, MICA DIELECTRIC: 40,000 mmf, ±1%, 500 v DC; molded low-loss bakelite, 2-3/4 in. lg, 1-5/16 in. wide, 1 in. high. General Radio Co, Part No. 505–462.	Fixed oscillator series grid coupling capacitor.
C3		Same as C2	Fixed oscillator series plate coupling capacitor.
C4	16–C–15171–1201	CAPACITOR, FIXED, AIR DIELECTRIC: 1 section; 890 mmf, 700 v AC peak voltage; 38 plates; 4-3/8 in. lg, 3-1/8 in. wide, 3-1/8 in. high. General Radio Co, Part No. 1107–25.	Fixed oscillator tuning capacitor.
C5		CAPACITOR, FIXED, MICA DIELECTRIC: 50,000 mmf, ±10%, 600 v DC; molded low-loss bakelite; 1-5/8 in. lg, 1-1/8 in. high, 29/64 in. deep. Cornell-Dubilier Electric Corp, Part No. Type 4–50,000.	Fixed oscillator plate r-f by-pass capacitor.
C6	16–C–48817–3101	CAPACITOR, FIXED, PAPER DIELECTRIC: 1 section; 1 mf, ±10%, 600 v DC; hermetically sealed metal case; 1-13/16 in. lg, 1 in. wide, 1-5/8 in. high excluding terminals; oil impregnated and filled. General Radio Co, Type No. COL–45.	Fixed oscillator screen grid r-f by-pass capacitor.
C7		Not used.	
C8	N16–C–61080–7346	CAPACITOR, VARIABLE, AIR DIELECTRIC: plate meshing type; 1 section; 140 mmf max, 7 mmf min, 600 v AC peak voltage; 1-7/32 in. lg, 15/16 in. wide, 1-7/32 in. high excluding shaft; 7/16 in. lg, 3/16 in. dia shaft; 37 plates, brass, nickel plated. Hammarlund Mfg Co, Part No. APC–140.	REVERSE coarse trimmer capacitor.
C9	16–C–57953–9201	CAPACITOR, VARIABLE, AIR DIELECTRIC: plate meshing type; single section; 0.000 to 1 mf, 500 v AC peak voltage; 1-1/8 in. lg, 1-5/8 in. wide, 1-5/16 in. high excluding shaft and bushing; 9/16 in. lg x 3/8-32 thd, bushing; 5/8 in. lg, 1/4 in. dia shaft; 3 brass cadmium plated plates. General Radio Co, Part No. 368–414–2.	REVERSE Δf trimmer capacitor.

TABLE 8-3. TABLE OF REPLACEABLE PARTS—Continued

REF. DESIG.	STOCK NUMBERS	NAME AND DESCRIPTION	LOCATING FUNCTIONS
C10		Same as C8.	DIRECT coarse trimmer capacitor.
C11		CAPACITOR, VARIABLE, AIR DIELECTRIC: plate meshing type; 1 section; 320 mmf max, 15.5 mmf min, 1000 v AC peak voltage; 3-7/32 in. lg, 1-11/16 in. wide; 1-11/16 in. high excluding shaft and bushing; 3/8 in. lg x 3/8-32 thd bushing; 17/32 in. lg, 1/4 in. dia shaft; 43 brass nickel plated plates. Hammarlund Mfg Co, Inc, Type No. MC-3255.	DIRECT 5000 cycle fixed oscillator frequency shift capacitor.
C12		CAPACITOR, VARIABLE, AIR DIELECTRIC: plate, meshing type; 1 section; 2 mmf max, 500 v AC peak voltage; 1-1/8 in. lg, 1-5/8 in. wide, 1-5/16 in. high excluding shaft and bushing; 9/16 in. lg x 3/8-32 thd bushing; 5/8 in. lg, 1/4 in. dia shaft; 3 brass nickel plated plates. General Radio Co, Part No. 368-414.	DIRECT Δf trimmer capacitor.
C13	16-C-30168-4113	CAPACITOR, FIXED, MICA DIELECTRIC: 500 mmf, $\pm$10%, 2500 v DC; molded low-loss bakelite; 1-5/8 in. lg, 1-1/8 in. high, 23/64 in. deep. Cornell-Dubilier Electric Corp, Type No. 4L-53050.	Fixed oscillator buffer amplifier grid capacitor.
C14	N16-C-46347-3139	CAPACITOR, FIXED, PAPER DIELECTRIC: 1 section; 250,000 mf, $\pm$10%, 600 v DC; hermetically sealed metal case; 1-13/16 in. lg, 1 in. wide, 3/4 in. high excluding terminals; Dykanol "G" synthetic oil filled and impregnated. Cornell-Dubilier Electric Corp, Catalog No. DYT-6025.	Buffer amplifier plate by-pass capacitor.
C15		Same as C13.	Variable oscillator buffer amplifier grid capacitor.
C16		Same as C1.	Variable oscillator grid capacitor.
C17		Same as C2.	Variable oscillator series grid coupling capacitor.
C18		Same as C2.	Variable oscillator series plate coupling capacitor.
C19 C20 C21 C22		CAPACITOR, VARIABLE, AIR DIELECTRIC: plate meshing type; 2 sections, 2 padders; 1400 mmf max, 1075 mmf min; 7-3/8 in. lg, 7-1/4 in. wide, 10-7/8 in. high excluding shaft; shaft extends 1 in. beyond mounting surface; capacitor consists of one variable section (C19); one fixed section (C20); one course trimmer section (C21); and one fine trimmer section (C22). All are mounted in a cast aluminum case. Dials, gears, indicators, lucite light rods, and dials are included. This capacitor assembly can only be calibrated in mfrs. lab. **Furnished Only As A Complete Unit.** General Radio Co, Part No. 622-401.	Variable oscillator frequency tuning capacitor.
C23		Same as C5.	Variable oscillator plate r-f by-pass capacitor.
C24		Same as C6.	Variable oscillator screen grid r-f by-pass capacitor.
C25		CAPACITOR, FIXED, MICA DIELECTRIC: 100 mmf, $\pm$10%, 2500 v DC; molded low-loss bakelite; 1-5/8 in. lg, 1-1/8 in. high, 23/64 in. deep. Cornell-Dubilier Electric Corp, Type 4L-53010.	Mixer grid capacitor.

C26	N16–C–31803–2413	CAPACITOR, FIXED, MICA DIELECTRIC: 2,000 mmf, ±10%, 1200 v DC; molded low-loss bakelite; 1-5/8 in. lg, 1-1/8 in. high, 23/64 in. deep. Cornell-Dubilier Electric Corp, Type 4L–22020.	Mixer r-f filter input capacitor.
C27		CAPACITOR, VARIABLE, AIR DIELECTRIC: plate meshing type; 1 section; 100 mmf max, 5.5 mmf min, 600 v rms peak voltage; 1-37/64 in. lg, 15/16 in. wide, 1-7/32 in. high excluding shaft and bushing; 9/32 in. lg, 1/4 in. dia bushing; 5/32 in. lg, 3/16 in. dia shaft beyond bushing; 27 brass cadmium plated plates. Hammarlund Mfg Co, Type No. APC–100 Type C.	Mixer r-f filter tuning capacitor.
C28		Same as C26.	Mixer r-f filter output capacitor.
C29	N16–C–23048–4560	CAPACITOR, FIXED, ELECTROLYTIC: 4 sections (C29, C31, C33, C39); 20 mf capacity per section, 450 v DC; hermetically sealed aluminum case, 3 in. high, 1-3/8 in. dia; **C29, C31, C33, C39 furnished only as a complete unit.** Sprague Electric Co, Type No. EL–420.	Mixer plate decoupling capacitor (C29).
C31			First audio amplifier plate decoupling capacitor (C31).
C33			Second audio amplifier plate decoupling capacitor (C33).
C39			Input amplifier plate by-pass capacitor (C39).
C30		Same as C5.	First audio amplifier grid capacitor.
C32		Same as C5.	Second audio amplifier grid capacitor.
C34		Same as C5.	Third audio amplifier grid capacitor.
C35	N16–C–19663–8301	CAPACITOR, FIXED, ELECTROLYTIC: 1 section; 16 mf, 150 v DC; aluminum body vented for excessive gas pressures, 1-1/2 in. lg. Aerovox Corp, Type PRS–EP150.	Third audio amplifier output coupling capacitor.
C36		Same as C5.	Audio input blocking capacitor.
C37		Same as C5.	Input amplifier grid capacitor.
C38		Same as C35.	Input amplifier output coupling capacitor.
C40	N16–C–33622–5345	CAPACITOR, FIXED, MICA DIELECTRIC: 10,000 mmf, ±10%, 300 v DC; molded low-loss bakelite; 1 in. lg, 5/8 in. wide, 5/16 in. deep; wax impregnated. Sprague Electric Co, Type No. 3AFM–11.	Power line r-f by-pass capacitor.
C41		Same as C40.	Power line r-f by-pass capacitor.
C42	16–C–20194–1019	CAPACITOR, FIXED, ELECTROLYTIC: 1 section; 100 mf, 450 v DC; hermetically sealed metal case; 4 in. lg, 1-3/8 in. dia. Sprague Electric Co, Type DFP–100MF.	Power supply filter capacitor.
C43		Same as C42.	Power supply filter capacitor.
C44		Same as C42.	Power supply filter capacitor.
E1	N16–K–700396–105	KNOB ASSEMBLY: round, black bakelite; for 3/8 in. dia shaft; two no. 10–32 set screws; brass insert; 5/8 in. deep shaft hole. General Radio Co, Part No. ZKNU–3, Dwg. No. KNS–1D.	Knob for main FREQUENCY variable capacitors C19, C20.

TABLE 8–3. TABLE OF REPLACEABLE PARTS—Continued

REF. DESIG.	STOCK NUMBERS	NAME AND DESCRIPTION	LOCATING FUNCTIONS
E2	N16–K–700396–107	KNOB: rd; phenolic; black; designed to accommodate 3/8 in. dia shaft, 5/8 in deep shaft hole; brass insert; white pointer mark; 1-15/16 in. dia. 13/16 in. thick. General Radio Co. Part No. NKSP–8.	Knob for REVERSE-DIRECT scale selection control switch S2.
E3	16–K–700333–759	KNOB: rd; phenolic; black; designed to accommodate 3/8 in. dia shaft, 5/8 in. deep shaft hole; brass insert; 1-5/16 in. dia, 3/4 in. thick. General Radio Co. Part No. KNS–6.	Knob for Δf REVERSE control C9.
E4		Same as E3.	Knob for Δf DIRECT control C12.
E5	N16–K–700335–761	KNOB: rd; phenolic; black; designed to accommodate 3/8 in. shaft, 5/8 in. deep shaft hole; brass insert; white pointer; 1-5/16 in. dia, 3/4 in. thick. General Radio Co. Part No. KNSP–6.	Knob for INPUT level control R34.
E6		Same as E5.	Knob for OUTPUT level control R22.
E7	N17–P–69135–7782	POST, BINDING: brass; bright alloy finish; 23/32 in. over-all height of post above mounting surface; 0.375 in. OD of post; mounting stud 0.138 in. dia, 11/16 in. lg x 6-32 thd. General Radio Co, Part No. BP–10, 11/16.	For making INPUT connection by means of two-point plug.
E8		Same as E7.	For making OUTPUT connection by means of two-point plug.
F1	N17–F–14303–175	FUSE, CARTRIDGE: 0.6 amp, 115 v; time delay, 135% for 1 hr and 200% for 60 sec max; ferrule type; one time; 1-1/4 in. lg, 1/4 in. dia glass body; anti-vibration construction. Littelfuse, Inc, Type No. 313.600.	Power supply line fuse.
F2		Same as F1.	Power supply line fuse.
H1	42–B–29975–565	BUTTON, PLUG: brass, black nickel plated, for 1/2 in. dia hole; 21/32 in. dia by 17/64 in. high. General Radio Co, Part No. 2BUS–422.	Covers panel access hole for C8.
H2		Same as H1.	Covers panel access hole for C10.
H3	N16–P–500001–206	POINTER, INDICATOR: nickel silver, chrome plated; approx over-all dim. 1-11/32 in. lg, 1-1/8 in. high, 9/32 in. thick; two no. 0.149 in. dia mounting holes on 3/4 in. mtg/c. General Radio Co, Part No. 706–38K.	Pointer indicator for Δf REVERSE dial scale N3.
H4		Same as H3.	Pointer indicator for Δf DIRECT dial scale N4.
H5		Same as H1.	Covers panel access hole for C22.
I1	G17–L–6305	LAMP, INCANDESCENT: 6-8 v, 0.25 amp; miniature screw base, T–3–1/4, bulb, clear; 7/8 in. high over-all, over 25 hr rated life, burns in any position. General Electric Corp, Lamp No. 44.	Indicating light for main FREQUENCY dial scale N1.
I2		Same as I1.	Indicating light for main FREQUENCY dial scale N2.

J1	N17–C–73142–1027	CONNECTOR, RECEPTACLE: 2 contacts, female, round, concentric; straight type; 1-3/4 in. lg excluding protruding contacts and terminals; 1-1/16 in. across flats; 7/8 in. dia; cylindrical shape; brass, bright alloy finish; bushing mounted on panel by 1-1/16 in. hex coupling nut threaded 15/16-27; coaxial type connector. General Radio Co, Type No. 874–406.	Audio frequency INPUT jack (on panel).
J2		Same as J1.	Audio frequency OUTPUT jack (on panel).
J3	N17–C–73107–1001	CONNECTOR, RECEPTACLE: 2 contacts, female, round, concentric; straight type; 1-13/16 in. lg, 1-1/4 in. dia; 50 ohms normal impedance; cylindrical body with hex mounting nut; brass, bright alloy finish, non-locking type, shell split from rear. General Radio Co, Part No. 874–P.	Audio frequency INPUT jack (on rear).
J4		Same as J3.	Audio frequency OUTPUT jack (on rear).
J5	N17–C–73443–8592	CONNECTOR, RECEPTACLE: 2 male, flat contacts; straight type; 31/32 in. lg, excluding protruding contacts; 1-7/8 in. wide, 1-1/4 in. high, 1-1/16 in. dia; cylindrical shape w/diamond shaped mounting flange; steel bright finish. General Electric Co, Type No. 39X370.	Jack (on rear) for connection to power supply line via cable W2.
L1	N16–R–28833–2134	REACTOR: filter choke, 1 section; 11.4 mh over-all inductance, 14 ohms DC resistance; 3 in. lg, 1.7 in. OD; winding treated w/moisture and fungus resistant lacquer. General Radio Co, Type No. 1107–26.	Fixed oscillator tuning inductor.
L2	N16–R–28866–4192	REACTOR: filter choke, 1 section; 60 mh over-all inductance, 65 ma DC; 140 ohms DC resistance; enclosed molded phenolic case; 1-5/16 in. dia, 1-13/16 in. high. General Radio Co, Part No. 379–R.	Fixed oscillator cathode r-f choke.
L3		Same as L1.	Variable oscillator tuning inductor.
L4		Same as L2.	Variable oscillator cathode r-f choke.
L5	N16–C–75681–5310	COIL, RADIO FREQUENCY: 250 mh at 50 kilocycles, 450 ohms DC resistance, 60 ma; 4,300 turns, No. 36E wire; bakelite tube form; no core; 1-7/16 in. lg, 1-1/8 in. dia, excluding terminals; includes mounting attachments and tuning devices. General Radio Co, Type 119–A.	Mixer r-f filter tuning inductor.
M1	N17–M–33911–8741	VOLTMETER: panel mounted; rectifier type, 50-60 cycles, single phase; round, black bakelite case, ±5% accuracy at full scale reading; 2,000 ohms per volt resistance; calibrated for non-magnetic panel. Weston Electrical Instrument Corp, Model 301, A-C Rectifier Type Range 10.	Output voltmeter.
R1	N16–R–50975–811	RESISTOR, FIXED, COMPOSITION: 1 megohm, ±10%; 1/2 watt power dissipation, F characteristic; 13/32 in. lg, 0.175 in. dia, excluding terminals; resistant to humidity and salt water immersion. International Resistance Co, Type No. RC20BF105K BTS.	Fixed oscillator grid leak.
R2	N16–R–50373–0231	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, ±10%, 1 watt power dissipation; F characteristic; 3/4 in. lg, 9/32 in. dia, excluding terminals. International Resistance Co, Type No. RC30BF223K BTA.	Fixed oscillator screen grid voltage divider (fixed portion).

TABLE 8-3. TABLE OF REPLACEABLE PARTS—Continued

REF. DESIG.	STOCK NUMBERS	NAME AND DESCRIPTION	LOCATING FUNCTIONS
R3	16-R-91565-3368	RESISTOR, VARIABLE: wire-wound element; rotating brush type; 1 section, 50,000 ohms, ±5%, 3 watts power rating; std A taper; phenolic body, 1-7/8 in. dia, 1-1/8 in. deep; round, linen bakelite shaft, screwdriver slot 1/32 in. wide, 1/16 in. deep in end; 0.250 in. dia shaft. General Radio Co, Type No. 301-462.	Fixed oscillator screen grid voltage divider (adjustable portion).
R4		Same as R1.	Fixed oscillator buffer amplifier grid leak resistor.
R5	N16-R-91030-9012	RESISTOR, VARIABLE: wire-wound element; rotating brush type; 1 section, 5,000 ohms, ±10%, 2 watts nominal power rating; std O taper; 1-1/8 in. dia, 9/16 in. deep molded bakelite housing; rd, metal shaft, screwdriver slot 3/64 in. wide, 1/16 in. deep in end 1/4 in. dia; 3/8 in. 32-thd, 3/8 in. lg, bushing; non-turn device located on 17/32 in. radius at 9 o'clock. Clarostat Mfg Co Inc, Type No. 43W-5000.	Fixed oscillator buffer amplifier cathode resistor, adjustable output DIRECT.
R6	N16-R-50517-231	RESISTOR, FIXED, COMPOSITION: 56,000 ohms, ±10%, 1 watt power dissipation; F characteristic; 3/4 in. lg, 9/32 in. dia, excluding terminals. International Resistance Co, Type No. RC30BF563K BTA.	Fixed oscillator buffer amplifier output coupling resistor.
R7	N16-R-49805-811	RESISTOR, FIXED, COMPOSITION: 560 ohms, ±10%, 1/2 watt power dissipation; F characteristic; 13/32 in. lg, 0.175 in. dia, excluding terminals. International Resistance Co, Type No. RC20BF561K BTS.	Fixed oscillator buffer amplifier cathode bias resistor.
R8		Same as R5.	Fixed oscillator buffer amplifier cathode resistor, adjustable output, REVERSE.
R9		Same as R2.	Variable oscillator buffer amplifier output coupling resistor.
R10		Same as R7.	Variable oscillator buffer amplifier cathode bias resistor.
R11	N16-R-50040-231	RESISTOR, FIXED, COMPOSITION: 2,700 ohms, ±10%, 1 watt power dissipation; F characteristic; 3/4 in. lg, 9/32 in. dia, excluding terminals. International Resistance Co, Type No. RC30BF272K BTA.	Variable oscillator buffer amplifier cathode resistor.
R12		Same as R1.	Variable oscillator buffer amplifier grid leak resistor.
R13		Same as R1.	Variable oscillator grid leak resistor.
R14		Same as R2.	Variable oscillator screen grid voltage divider (fixed portion).
R15		Same as R3.	Variable oscillator screen grid voltage divider (adjustable portion).

R16	16-R-66075-7571	RESISTOR, FIXED, WIRE WOUND: inductive winding; 1500 ohms, ±5%, 4 watts power dissipation, 150°C max continuous operating temp; 1-3/4 in. lg, 5/16 in. OD, excluding terminals. International Resistance Co, Type No. 1-3/4"A-1500.	Oscillator plate supply, series regulating resistor.
R17	N16-R-50481-231	RESISTOR, FIXED, COMPOSITION: 47,000 ohms total resistance, ±10%, 1 watt power dissipation; F characteristic; 3/4 in. lg, 9/32 in. dia, excluding terminals. International Resistance Co, Type No. RC30BF473K BTA.	Mixer input coupling resistor.
R18	N16-R-50633-811	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, ±10%, 1/2 watt power dissipation; F characteristic; 13/32 in. lg, 0.175 in. dia, excluding terminals. International Resistance Co, Type No. RC20BF104K BTS.	Mixer grid leak.
R19	N16-R-50310-231	RESISTOR, FIXED, COMPOSITION: 12,000 ohms, ±10%, 1 watt power dissipation; F characteristic; 3/4 in. lg, 9/32 in. dia, excluding terminals. International Resistance Co, Type No. RC20BF123K BTA.	Mixer plate resistor.
R20	N16-R-50418-231	RESISTOR, FIXED, COMPOSITION: 33,000 ohms, ±10%, 1 watt power dissipation; F characteristic; 3/4 in. lg, 9/32 in. dia, excluding terminals. International Resistance Co, Type No. RC20BF333K BTA.	Mixer r-f filter load resistor.
R21		Same as R17.	Mixer decoupling plate resistor.
R22	16 R 87769 4351	RESISTOR, VARIABLE: composition element; 1 section, 30,000 ohms, ±10%, 2.25 watts nominal power rating; std C taper; 1-1/16 in. dia, 9/16 in. deep, phenolic body; rd, 1 in. lg metal shaft, screwdriver slot 0.047 in. wide, 0.063 in. deep slot in end; 1/4 in. dia shaft; 3/8-32 thd by 3/8 in. lg bushing; non-turn device located on 17/32 in. radius at 9 o'clock. Allen Bradley Co, Type No. JU3031-SD3100.	Mixer output (gain) control (adjustable portion).
R23	N16-R-50516-811	RESISTOR, FIXED, COMPOSITION: 56,000 ohms, ±10%, 1/2 watt power dissipation; F characteristic; 13/52 in. lg, 0.175 in. dia, excluding terminals. International Resistance Co, RC20BF563K BTS.	Mixer output (gain) control (fixed portion).
R24	N16-R-49806-231	RESISTOR, FIXED, COMPOSITION: 560 ohms, ±10%, 1 watt power dissipation; F characteristic; 3/4 in. lg, 9/32 in. dia, excluding terminals. International Resistance Co, RC30BF561K BTA.	First audio amplifier cathode bias resistor.
R25		Same as R9.	First audio amplifier plate resistor.
R26		Same as R9.	First audio amplifier plate decoupling resistor.
R27		Same as R1.	Second audio amplifier grid leak resistor.
R28		Same as R24.	Second audio amplifier cathode bias resistor.
R29		Same as R9.	Second audio amplifier plate resistor.
R30		Same as R9.	Second audio amplifier plate decoupling resistor.
R31	N16-R-50975-811	RESISTOR, FIXED, COMPOSITION: 1 megohm, ±10%, 1/2 watt power dissipation; F characteristic; 13/32 in. lg, 0.175 in. dia, excluding terminals. International Resistance Co, RC20BF105K BTS.	Third audio amplifier grid leak.

TABLE 8–3. TABLE OF REPLACEABLE PARTS—Continued

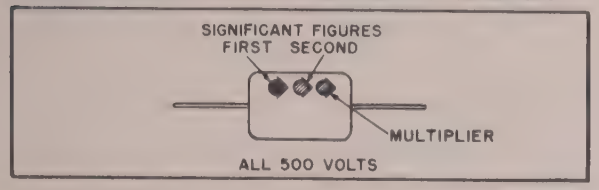
REF. DESIG.	STOCK NUMBERS	NAME AND DESCRIPTION	LOCATING FUNCTIONS
R32		Same as R24.	Third audio amplifier cathode bias resistor.
R33	N16–R–50067–231	RESISTOR, FIXED, COMPOSITION: 3,300 ohms, ±10%, 1 watt power dissipation; F characteristic; 3/4 in. lg, 9/32 in. dia, excluding terminals. International Resistance Co, RC30BF332K BTA.	Third audio amplifier cathode resistor.
R34	N16–R–87849–4467	RESISTOR, VARIABLE: composition element; 1 section, 50,000 ohms, ±10%, 2.25 watts nominal power rating; std C taper; 1-1/16 in. dia, 9/16 in. deep, phenolic body; rd, metal shaft 1 in. lg screwdriver slot 0.047 in. wide, 0.063 in. deep slot in end; 1/4 in. dia shaft 3/8-32 thd by 3/8 in. lg bushing, non-turn device located on 17/32 in. radius 9 o'clock. Allen Bradley Co, Type No. JU5031 SD3100.	Audio input control.
R35		Same as R1.	Input amplifier grid leak resistor.
R36		Same as R7.	Input amplifier cathode bias resistor.
R37		Same as R33.	Input amplifier cathode resistor.
R38		Same as R9.	Input amplifier plate decoupling resistor.
R39	17–R–68371–1536	RESISTOR, FIXED, WIRE WOUND: inductive winding; 270 ohms, ±10%, 2 watt power dissipation, 90°C max continuous operating temp; 1-3/4 in. lg, 21/64 in. dia, excluding terminals. International Resistance Co, BW–2.	Power supply filter resistor.
R40		Same as R39.	Power supply filter resistor.
R41		Same as R39.	Power supply filter resistor.
R42	N16–R–68301–2521	RESISTOR, FIXED, WIRE WOUND: inductive winding; 5.6 ohms, ±10%, 1/2 watt power dissipation, 90°C max continuous operating temp; 21/32 in. lg, 15/64 in. dia excluding terminals. International Resistance Co, Type No. RU3C5R6K BW–1/2.	Dial signal lights' series resistor.
R43		Same as R7.	Fixed oscillator grid suppressor resistor.
R44		Same as R7.	Variable oscillator grid suppressor resistor.
S1	N17–S–73198–6537	SWITCH, TOGGLE: DPST, 3/6 amp, 250/125 volt; 1-5/32 in. lg, 11/16 in. wide, 9/16 in. high excluding terminals, bushings, barriers and handle; bat type handle, 25/32 in. lg, excluding length of bushing; 15/32–32 thd bushing 15/32 in. lg from mounting surface. Arrow-Hart and Hegeman Electric Co, Part No. 81024–BM.	Power supply OFF-ON switch.
S2		SWITCH, ROTARY: 2 sections; 2 positions; non-"pile-up" type, 3 poles, 2 throws; brass contacts, silver plated; 1-27/32 in. lg, 1-33/64 in. wide, 1-7/8 in. high; flatted shaft, 1 in. lg, 1/4 in. dia. General Radio Co, Part No. SWRW–46.	Fixed oscillator DIRECT-REVERSE switch.

T1		TRANSFORMER, POWER, STEP-DOWN AND STEP-UP: 115/230 v AC, 50-60 cycle; single phase; No. 1 secondary 6.97 v, No. 2 secondary 6.97 v, No. 3 secondary 575 v, No. 3 secondary center tapped; glyptal impregnated, 3-7/32 in. lg, 2-25/32 in. wide, 2-5/8 in. high; internal shielding. General Radio Co, Type No. 485–439–2.	Power supply transformer.
TB1	17–B–78083–3268	TERMINAL BOARD: 3/32 in. punching bakelite (XPLW); 16 terminals; solder lug type; w/o barriers; 3 in. lg, 1-5/32 in. wide, 3/32 in. thick; seven 0.177 in. dia holes spaced 3/8 in. C to C located in a row in center of board. General Radio Co, Part No. ZMDT–2, 3 in. lg.	Mounts resistors R21, R25, R26, R29, R30, R31, R32, R38.
V1	N16–T–56138	ELECTRON TUBE: sharp cut-off pentode JAN Type 6AC7.	Fixed frequency oscillator tube (42 or 47 kc).
V2	N16–T–56352	ELECTRON TUBE: medium-mu triode JAN Type 6J5GT/G.	Buffer amplifier tube.
V3		Same as V2.	Buffer amplifier tube.
V4		Same as V1.	Variable frequency oscillator tube (42 to 47 kc).
V5A/B	N16–T–56682	ELECTRON TUBE: medium-mu twin triode JAN Type 6SN7GT.	A—Detector tube B—Output amplifier tube.
V6A/B		Same as V5A/B.	A—Mixer tube B—Output amplifier tube.
V7		Same as V2.	Input amplifier tube.
V8	N16–T–56855	ELECTRON TUBE: full-wave vacuum rectifier JAN Type 6X5GT/G.	Full-wave rectifier tube.
V9	N16–T–53060	ELECTRON TUBE: voltage regulator JAN Type OD3.	Voltage regulator tube.
XF1	17–F–74267–5075	FUSEHOLDER: extractor post type; 15 amp; black bakelite; brass contacts, spring type; 2-7/32 in. lg, 11/16 in. dia; single 0.512 in .dia mounting hole. Bussman Mfg Co, Type No. HKP.	Fuseholder for fuse F1.
XF2		Same as XF1.	Fuseholder for fuse F2.
XV1	N16–S–63529–1961	SOCKET, ELECTRON TUBE: 8 contacts, beryllium copper, silver-plated; octal; 1-3/16 in. lg, 1-13/16 in. wide, 1/2 in. high; molded mica low-loss body; 1-1/4 in. dia mounting hole required. Cinch-Jones Mfg Co, Part No. 51B13679.	Socket for electron tube V1.
XV2		Same as XV1.	Socket for electron tube V2.
XV3		Same as XV1.	Socket for electron tube V3.
XV4		Same as XV1.	Socket for electron tube V4.
XV5A/B		Same as XV1.	Socket for electron tube V5A/B.
XV6A/B		Same as XV1.	Socket for electron tube V6A/B.
XV7		Same as XV1.	Socket for electron tube V7.
XV8		Same as XV1.	Socket for electron tube V8.
XV9		Same as XV1.	Socket for electron tube V9.

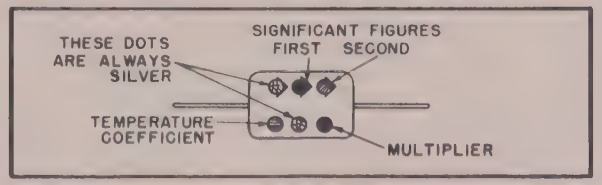
TABLE 8–4. APPLICABLE COLOR CODES AND MISCELLANEOUS DATA

CAPACITOR COLOR CODES

RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



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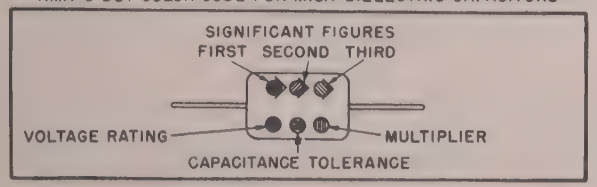
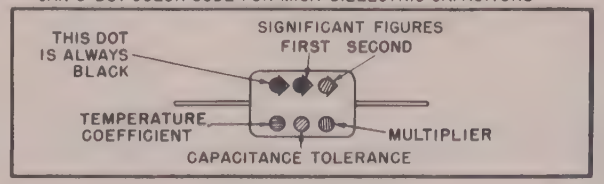
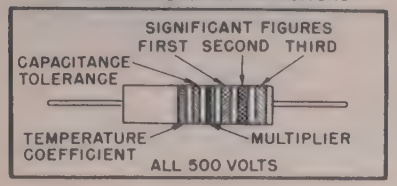


JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

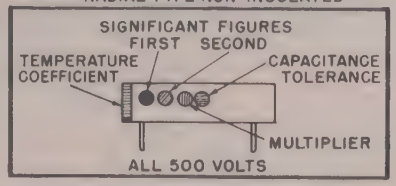


RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS

RADIAL TYPE NON-INSULATED



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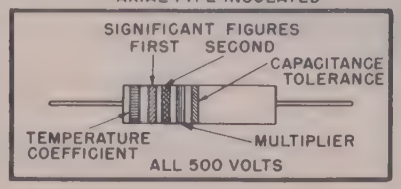


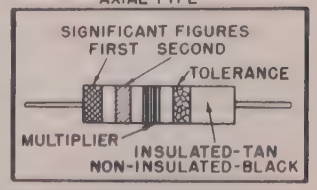
RMA: RADIO MANUFACTURERS ASSOCIATION
JAN: JOINT ARMY-NAVY

RESISTORS				CAPACITORS				
				MULTIPLIER				
TOLERANCE	MULTIPLIER	SIGNIFICANT FIGURE	COLOR	RMA MICA AND CERAMIC-DIELECTRIC	JAN MICA AND PAPER-DIELECTRIC	JAN CERAMIC DIELECTRIC	VOLTAGE RATING	TEMPERATURE COEFFICIENT
	1	0	BLACK	1	1	1		A
	10	1	BROWN	10	10	10	100	B
	100	2	RED	100	100	100	200	C
	1,000	3	ORANGE	1,000	1000	1000	300	D
	10,000	4	YELLOW	10,000			400	E
	100,000	5	GREEN	100,000			500	F
	1,000,000	6	BLUE	1,000,000			600	G
	10,000,000	7	VIOLET	10,000,000			700	
	100,000,000	8	GRAY	100,000,000		0.01	800	
	1,000,000,000	9	WHITE	1,000,000,000		0.1	900	
5	0.1		GOLD	0.1	0.1		1000	
10	0.01		SILVER	0.01	0.01		2000	
20			NO COLOR				500	

RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE



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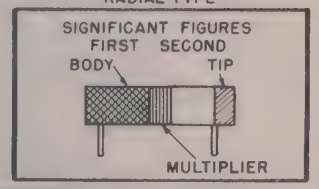

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS

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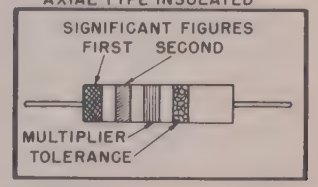

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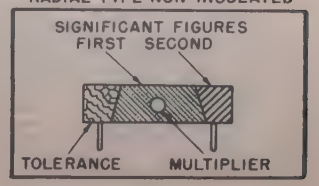

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